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I. Agriculture

Abstract Nos. 1—21

1. Studies on the mechanism of absorption and assimilation of urea. Yakichi NOGUCHI and Tomota SUGAWARA (Studies on Foliar Application 1-12, 1954)

2. Studies on the production and behavior of carbohydrates in rice plant. I. Changes of principal constituents in each organ accompanied by its development. Yoshiji TOGARI, Yoshimi OKAMOTO and Atsuhiko KUMURA (Proc. Crop Sci. Soc. Japan **22**, 95-97, 1954)

The present research has been carried out for the purpose of clarifying the mode of grain development in the rice plant, through which the basis of rice culture can be established. In these studies, determining the principal constituents of plant materials by chemical analysis has been adopted as a chief method for examining the living state of the plant.

In 1951, Paddy rice, "Nōrin No. 8," was pot-cultured by the usual method under natural conditions, and the dry weight and chemical constituents of each of its organs were determined at each stage of development.

The results obtained were as follows:

(1) Immediately after transplanting, nitrogen percentage of each organ was comparatively low, but much starch was accumulated in leaf sheath and culm.

(2) At the time of vigorous tillering, nitrogen percentage was the highest in each organ and starch percentage in culm and leaf sheath was very low.

(3) From the panicle primordium forming time to the beginning of ripening, nitrogen percentage of each organ reduced rapidly, and starch was accumulated in culm and leaf sheath. About 2 weeks before heading, the panicle began its rapid development, while the nitrogen content (absolute amount) of leaf reduced. This might be caused by nitrogen translocation to panicle.

(4) With the progress of ripening, perhaps by translocation to panicle, starch content in culm and leaf sheath reduced.

Although starch content of panicle increased rapidly, the amount of all other constituents were nearly constant at this stage. Therefore, almost all photosynthesised carbohydrates were seemed to be accumulate in panicle in the form of starch.

3. Studies on the production and behavior of carbohydrates in rice plant. II. On the accumulation and distribution of starches in the organs of rice plant with its development of growth. Yoshiji TOGARI and Kanoe SATO (Proc. Crop Sci. Soc. Japan **22**, 98-99, 1954)

The process of accumulation and distribution of starch in the organs of rice plant, with its development of growth, was observed, chiefly microscopically, using 0.1% J-KJ solution. As the parts which accumulated much starch were both the base of leaf-sheath and the internode of culm, the authors estimated the relative amount

of starch accumulated there, by the degree of response to the dye. The results observed were as follows:

(1) A large number of minute starch-grains accumulated in all young organs before elongation, but they disappeared during elongating period being probably consumed for enlargement of cells. When the elongation ceased accumulation of starch took place again and thereafter increased in amount.

(2) The behavior of starch in the leaf-sheath of the locus lower than the 12th leaf-sheath was different from that of higher one: In the former starch disappeared thoroughly before the development of young culm and panicle and the leaves soon died, but in the latter it attained maximum in amount about 10 days before and decreased just before heading date, again increasing till the beginning of its translocation to grains and decreased gradually thereafter.

(3) In the lower internodes (8-9∼10-11) starch decreased in amount in tillering stage, but later, the amount in all internodes increased and attained its maximum 10 days after heading when fruiting began, and then decreased with the progress of translocation. At maturity, the lower internodes restored considerable amount of starch, but in rachis and peduncle it was lost completely.

4. Germination of vegetable seeds under various concentrations of oxygen and carbon dioxide. Yutaka HORI and Tadayoshi SUGIYAMA (Journ. Hort. Assoc. Japan **22**, 72-80, 1953)

Seed germination of 19 kinds of vegetables under various concentrations of O_2 and CO_2 was studied by means of the continuous aerating system, which proved to be satisfactory in keeping constant compositions of gas mixtures throughout the experiments.

The most kinds of seeds examined required 10% or more O_2 concentration for the pratically normal germination, and the minimum O_2 concentration that permitted any germination was 5% or below and was influenced little by the temperature, although there was considerable variations among the kinds of crops.

Over 20% of cucumber and Welsh onion, which were germinable under the lowest O_2 concentration, germinated under 1% O_2 as much as in the atmosphere, and over 50% under 2% O_2. Cerely and radish, on the contrary, showed no or poor germination even under 5% O_2 and were the highest O_2 requisitors. The others, including four groups, Chinese cabbage and turnip, garland chrysanthemum and leaf mustard, pepper and tomato, carrot, cabbage, squash and edible burdock in this order, situated between the two above mentioned, regarding to their germinability under lower O_2 concentrations.

The inhibitory effect of CO_2 in the 15% O_2 series was not so conspicuous, and was recognizable clearly only under the highest concentration (40% CO_2). When O_2 concentration was lowered to 5%, germination was decreased and retarded markedly, and browning of roots and root tips was frequently induced under higher CO_2 concentrations.

There seemed to have some differences among the seeds in their germinability under higher CO_2 concentrations. Under 40% CO_2 in both 15% and 5% O_2 series, Welsh onion and Chinese cabbage germinated over 70% as much as under 0% CO_2, while carrot, radish and squash germinated poorly even under 20% CO_2 in 15% O_2 series.

In the seeds of cruciferous plants and others, a kind of dormancy could be induced when O_2 concentration was lowered but not absent, or more easily when CO_2 was added with reduced O_2. This artificially induced dormancy could be clearly broken by the low temperature treatment as well as by the natural dormancy.

5. Dormancy of the seeds of leaf mustards. II. Yutaka HORI and Tadayoshi SUGIYAMA (Journ. Hort. Assoc. Japan **22**, 223-229, 1954)

In the previous paper, the authors reported that the mature seeds of leaf mustards except Negarashi variety had a kind of dormancy which was gradually broken in 2 or 3 months in dry storage after harvesting, or which could be easily broken by the low temperature treatments.

In this study, several other methods or reagents effective in breaking this dormancy were investigated, and the following results were obtained.

(1) The seed coats were observed to be permeable to water, and the radicles started their growth immediately when the swollen seed coats were removed carefully.

(2) Dormant seeds of Katsuona variety germinated well when washed by running water for six hours or more, but could not germinate when merely soaked in water for 20 hours or more.

(3) Germination of dormant seeds was not obtained by increasing concentration of oxygen, or both oxygen and carbon dioxide simultaneously.

(4) Thiourea was effective in breaking dormancy of leaf mustard seeds, and its effective concentration in our method was 0.5 to 1% at the middle stage of dormancy. Urea was also as effective as thiourea and its effective concentration was wider, that is, 0.1 to 1%, but 0.1% was less effective than the higher and lower concentrations.

(5) The effect of thiocyanates was not decisive, while some amino compounds, such as alanine and arginine were as effective as urea in 0.02 to 0.5% concentrations, and ammonia was also effective in 0.005 to 0.5% concentrations. Nitrates and ammonium salts had no decisive effect. The possibility that amino compounds were effective through ammonia produced in their hydrolysis seemed to be scarce.

(6) The mechanism of the dormancy was discussed. There seemed to be much possibility that there is some inhibiting substances in the seed coats.

6. Influence of the forms of nitrogen supplied on the growth of vegetable crops. Masatoshi IWATA and Takenobu TANIUCHI (Journ. Hort. Assoc. Japan **22**, 183-192, 1953)

(1) Experiments were carried out in order to clarify the influences of the forms of nitrogen supplied on the growth, yields, and leaf inorganic constituents of several vegetable crops, in sand cultures under glass. Materials tested were tomato, kidney bean, turnip, spinach, cabbage and onion. As for treatments, seven nutrient solutions with different proportions of NO_3–N and NH_4–N were prepared by combination of $NaNO_3$, $(NH_4)_2SO_4$ and NH_4NO_3. Their ratios were as follows: 10:0 (all NO_3–N), 9:1, 7:3, 5:5, 1:9, 0:10 (all NH_4–N). The total nitrogen content of all solutions was the same (140 p.p.m.), and all known nutrient ions were provided in constant proportion except Na and SO_4. All treatments were repeated in triplicate.

(2) In the crops tested, plants supplied with larger proportion of NO_3–N (10:0 to 5:5) made excellent growth, and generally, among them, there was no significant

difference. On the contrary, plants supplied with more NH_4–N (3:7 to 0:10) were stunted in growth, and among them, the more NH_4–N ratio increased, the more the growth decreased.

(3) Injurious symptoms of excess NH_4–N in the spring and fall crops emerged earlier and developed more readily than those of winter crops. Usually, all NO_3–N plant produced light green colored foliage, and with increased proportion of NH_4–N, foliage became blue green or darker green step by step, but at the extreme such as 1:9 to 0:10 treatments, plants suffered from leaf-burning and subsequent defoliation. Moreover, anthocyanin pigments developed in cabbage, and leaf surface were rather uneven and leathery in turnip and kidney bean.

Roots also suffered from injuries of excess NH_4–N, consequently, with the disorder of water absorption by root, leaves tended to curve upwards and withered.

(4) The amount of nitrogen and phosphorus in the leaves was higher in the case of the plants supplied with more NH_4–N compared with the plants supplied with more NO_3–N. The relation was, on the contrary, reverse between the amount of both calcium and magnessium and the forms of nitrogen. It was difficult to find a definite connection concerning to potassium due to complicated antagonism among cations such as $K^{\cdot}$, $Na^{\cdot}$, $NH_4^{\cdot}$ and so on.

7. Responses of vegetables to foliar applications of nitrogenous and phosphatic compounds. Tadayoshi SUGIYAMA, Arata KITAJIMA, Yutaka MACHIDA and Hitoo YASHIRO (Studies on Foliar Application 31-37, 1954)

In recent years, much attention have been paid to the foliar application of fertilizers to the crops. In this study, practical values of the foliar applications were tested on the vegetable crops.

(1) After having been grown for a month with the full nutrient in sand culture, Komatsunas (a variety of leafy Brassica) were sprayed with nitrogenous compounds. Urea and ammonium nitrate were promising, but ammonium sulfate and sodium nitrate were not effective. Ure sprays promoted the growth of the plants which were grown in the minus nitrogen culture solution, but their weight were far less than that of the plants which were supplied with full nutrient and were not sprayed.

(2) Turnips, grown in the high (15 m.e.) and low (5 m.e.) levels of nitrogen in culture solutions, were sprayed with urea and ammonium nitrate solution three times. The sprays promoted the growth of the plants, but the plants which were grown in the low nitrogen level and were sprayed, could not take up the plants which were grown in the high nitrogen level, but were not sprayed.

From these results, ample soil supply of nitrogen seemed to be necessary for the vigorous growth of the vegetables, even when nitrogen was supplied by the foliar sprays.

(3) Various phosphatic compounds were applied to tomato seedlings with several leaves, by dipping the tops in the solutions. They were grown in the pots filled with phosphorous deficient soil. NaH_2PO_4, $NH_4H_2PO_4$, and KH_2PO_4 were more effective, but glycero-phosphate and meta-phosphoric acid were less effective and ortho-phosphoric acid caused severe injuries in the concentrations used (25 and 50 m.e.).

(4) Potato plants were grown in the pots filled with phosphorus deficient soil. Superphosphate of 0, 10, 20 and 40 g. per plant were applied and some of the 10 g

plants were sprayed with 1% solutions of $NH_4H_2PO_4$ or KH_2PO_4 four times. The more the amounts of the superphosphate supplied, the greater the yield, but yield of the plants which were supplied with 10 g of superphosphate and were sprayed four times with the phosphoric compounds was nearly equal to that of the plants supplied with 40 g superphosphate.

8. **Ecological studies on strawberry varieties** (A co-operative work). Tadayoshi SUGIYAMA and Makoto KAWASE [The co-operators: Sadao ABE, Kyushu Agr. Exp. Sta. and Shozaburo SASAKI, Tohoku Agr. Exp. Sta.] (Varietal Differences of Responses to Ecological Factors in Vegetable Crops 45-54, 1954)

The studies were carried out to test the ecological characters of strawberry varieties in the three localities having different climates: Kurume (Kyushu), Tokyo (Kanto), and Fujisaki (Tohoku). The results obtained were as follows:

(1) The dates of blooming of the first flowers were advanced in the warmer regions, and the variety differences were much greater in Kyushu and Tokyo than Tohoku, where most varieties started to bloom in a few days. Variety differences in the date of blooming of the last flowers was, however, much smaller than that of the first flowers. Therefore, blooming period of early blooming varieties was much longer than that of the late blooming ones, especially in the warmer regions.

(2) As to the date of first picking of berries, the variety differences were rather small when compared with the differences in the date of blooming of first flowers. This seemed to be due to the fact that the low temperature prevailing in the early spring prevented setting of early flowers, and, or retarded ripening of early berries. Variety differences in the date of last picking were very small in every locality.

(3) Number of flowers and flower clusters per plant decreased from warmer to cooler localities in the order of Kurume, Tokyo and Fujisaki. Average weight of fruit decreased in the reversed order.

(4) Varieties belonging to the type which were bearing smaller number of flower clusters and flowers produced poor crops under the cooler cimlate. Varieties belonging to the type which were bearing larger number of flower clusters and flowers produced a large number of small sized berries under the warmer climate.

Most of the early blooming varieties were shy bearers in Kyushu and Tokyo.

In addition to the above mentioned characters, many other ones, such as capacity of runner plant production, resistance to summer heat, drought, and winter cold, responces to cultural systems, etc., seemed to be important factors determing the regional adaptability of strawberry varieties.

9. **Ecological studies on onion varieties** (A co-operative work). Tadayoshi SUIGIYAMA and Makoto KAWASE [The co-operators: Tadashi IMAZU and Yoshihisa ARANISHI, Naniwa Univ., Eikichi SAWADA and Sadanori INOUE, Hokkaido Univ., Makoto SHISA and Shozo YANATORI, Niigata Univ. and Sadao ABE, Kyushu Agr. Exp. Sta.] (Varieties Differences of Responses to Ecological Factors in Vegetable Crops, 16-32, 1954)

In order to clarify the adaptation and geographical distribution of the onion varieties cultivated in Japan, a co-operative work was carried out at the following five regions: Sapporo, Niigata, Tokyo, Osaka and Kurume.

(1) Results of experiments on autumn sowing—The rate of bolting was higher when varieties were grown in the south, and extremely low in the north. As to the variety differences, the rate of bolting was high in "Sapporo-ki", a variety for spring sowing, while "Imai strain", which had been selected from "Senshu-ki", and two early varieties, "Kaizuka-wase" and "Aichi-shiro", were low. The date of bulb formation was advanced when grown in the warmer region and its variety difference was observed distinctly, but when grown in a cooler region, it was impossible to observe the variety difference of bulb formation. Earlier varieties which can form the bulbs under short-day conditions were found to show their bulbing nature more active when grown in a warmer region. Later varieties, on the contrary, gave good results in cooler regions.

(2) Results of experiments on spring sowing—Even in the condition of long day and relatively high temperature, the bulbs do not begin to develop before some growth of leaves is noted. In this case the bulbs of earlier varieties developed more rapidly than those of later varieties. In a cooler region such as Hokkaido, later variety, "Sapporo-ki", showed its superior ability and "Senshu-strains" showed the best results in warmer regions.

(3) Results of investigation on the initiation of floral primodia—The date of the initiation of floral primordia in "Senshu-ki" onion was from early February to middle of February in Kyushu, Osaka and Tokyo, from March to early April in Niigata and from middle to late April in Hokkaido. The mean temperature of the above mentioned periods was about 5-10°C.

10. Stem rot of peanut. Hidefumi ASUYAMA and Susumu YAMANAKA (Ann. Phytopath. Soc. Japan **18** [1-2], 28-32, 1953)

Since 1947, stem rot of peanut caused by a *Diplodia* has been found in some fields in the Kanto district. The pathogen produces pycnia on the affected stems and petioles. Immature pycniospores are hyaline and 1-celled, while mature spores are dark and 1-2 celled, measuring $19\text{-}30 \times 10\text{-}17\,\mu$ in size. The perfect stage has not been found on the plants or in culture. The organism grows well on media of various kinds. The cardinal temperatures are 12-30∼31-40°C. Optimum pH for growth is 4.0∼6.1. The culture isolated from peanut could kill not only peanut but also beans. They caused rots on melon, apple, Satsuma orange, corn-ear, and cotton-boll. On adzuki bean (*Phaseolus angularis* WIGHT), soybean and sweet potato, they simply produced necrotic lesions.

Morphologically and physiologically the organism resembles closely with each of *Diplodia gossypina*, *D. tubericola*, *D. natalensis*, and *D. frumenti*, and is believed to be a strain of the collective species including these allied species. It still remains the need for further investigation for identification, but the name of *D. natalensis* was adopted tentatively, following JACOWAY and RAMSEY.

11. Studies on the mechanism of action of insecticides (VI). DDT symptoms in the cockroach, with special reference to the effect of temperature. Teruo YAMASAKI and Toshio ISHII (Ōyō-Kontyū **9**, 87-96, 1953)

The course of DDT symptoms in American cockroach is as follows: latent period, period of locomotor instability and ataxia, convulsive period, paralytic period, and

death. It has been suggested that the augmentation of repetitive excitability of neurone soma is a primary action of DDT.

DDT is more effective on the cockroach at low temperature (16°C) than at high temperature (30°C) either by injection or by topical application. Symptoms are completely reversible with appropriate doses upon changing the temperature; poisoned reaches at low temperature can recover completely when transferred to high temperature; and symptoms develop again when the animals are returned to low temperature, and so on. The mechanism of negative temperature coefficient of action of DDT has been discussed. It has been inferred that the site of primary and the most important action of DDT, neurone soma, is more sensitive to unstabilizing action of DDT at low temperature than at high temperature, and this factor of nerve sensitivity plays the most important rôle in negative temperature coefficient of DDT. The nerve is generally excited more repetitively at low temperature than at high temperature, and this nerve function may be correlated some way to the temperature coefficient of nerve sensitivity to DDT.

12. Studies on the mechanism of action of insecticides (VII). Activity of neurone soma as a factor of development of DDT symptoms in the cockroach. Teruo YAMASAKI and Toshio ISHII (Botyu-Kagaku **19**, 1-14, 1954)

Nervous activity in the DDT poisoned American cockroach, *Periplaneta americana* L., has been studied electrophysiologically with amplifier and oscillograph for the purpose of studying the mechanism of development of DDT symptoms.

Spontaneous activity of the giant neurones in the DDT poisoned roach increased in the period of locomotor instability and ataxia and it decreased in the convulsive period. Trains of impulses in the sensory neurones are induced by the injection of DDT through the leg and are also detected in the poisoned roach with symptoms of locomotor instability and ataxia but not in the convulsive period.

The foregoing experimental evidence clearly supports our hypothesis concerning the mechanism of development of DDT symptoms that have been published already in our previous paper. DDT acts exclusively as a nerve poison, and it is a primary action of DDT to augment the repetitive excitability of neurone soma. The augmentation of repetitive excitability of neurone somata in both the sensory and the motor symptom causes the abnormality in the synaptic transmission, which brings about disorder of the reflex function, i. e., the initial symptoms of postural and locomotor instability and ataxia. Convulsion, the secondary step of the course of DDT poisoning, is brought about by the secondary or deteriorative effect of poisoning to the nervous system, after the primary or unstabilizing action has passed away. DDT has no intimate relation to the death of the poisoned insect, but paralysis and death are the inevitable results due to the deterioration of the nerve.

13. Studies on the mechanism of action of insecticides (VIII). Effects of temperature on the nerve susceptibility to DDT in the cockroach. Teruo YAMASAKI and Toshio ISHII (Botyu-Kagaku **19**, 39-46, 1954)

Trains of afferent impulses from the campaniform organs are induced in American cockroach by the injection of DDT through the leg. These can be observed in the crural nerve with amplifier and oscillograph. In this report, we are concerned with a comparison of the effective dosages of DDT for the initiation of trains in the nerve

at low and high temperatures, and also that of the effectiveness of DDT injected in the insect body to develop the initial poisoning symptom or locomotor instability.

Frequencies of the appearance of trains of impulses after injection of DDT of the suprathreshold concentrations are lower at the temperature of 16°C than at 30°C. The threshold concentration of DDT to induce trains is much lower at the temperature of 16°C than at 30°C, as indicated by the Q_{10} value, 0.1813. Trains of impulses are rarely initiated at 30°C when DDT of about the threshold concentration at 30°C is injected, but when the temperature is lowered from 30°C to 16°C after a single injection, trains of impulses can be induced in higher frequencies, as the concentration is above the threshold value for 16°C. These trains disappear, however, when temperature is transferred back to 30°C. Thus the initiation of trains by the toxic action of DDT is reversible. The effectiveness of DDT to develop the initial poisoning symptoms also indicates a negative temperature coefficient, with Q_{10} as $0.3167 > Q_{10} > 0.1177$.

Thus our hypothesis about the negative temperature coefficient of the action of DDT established in our previous paper has been clearly demonstrated: DDT acts more effectively as insecticide at lower temperature, and the poisoning symptoms are reversible upon changing the temperature when appropriate dose is applied. Neither the penetrability of DDT through the cuticle nor the detoxication of DDT within the insect body can account for the mechanism of the negative temperature coefficient. Nervous system in the roach is more susceptible to the action of DDT at lower temperature than at higher temperature, in consequence of which DDT acts as insecticide more effectively in the former case. Reversibility of appearance of trains in changing the temperature presents a satisfactory explanation for the reversible poisoning symptoms with the change of temperature.

14. Studies on the mechanism of action of insecticides (IX). Repetitive excitation of the insect neurone soma by direct current stimulation and effects of DDT. Teruo YAMASAKI and Toshio ISHII (Jap. Journn. Appl. Zool. **19**, 16-28, 1954)

Repetitive excitation of the giant neurone soma by direct current stimulation in American cockroach and the effects of DDT on it have been studied by the oscillographic analysis.

Neurone soma can be excited repetitively by the passage of direct current if the soma is cathode, spike frequency increasing with the rise of stimulating potential. The rheobase of the soma is much lower than the axon. Spontaneous activity of neurone soma may be accelerated by the catelectrotonus, and inhibited by the anelectrotonus.

Experiments on the isolated giant fibre preparation clarified the three types of the repetitive excitation: the first type shows a short latent period, high frequency of the spikes and the rapid adaptation. The second type also shows a short latent period, but the spike frequencies are lower than that in the first type, and the adaptation is much slower. The third type possesses a very long latent period and the very slow adaptation.

At the lower temperature (16°C), the spontaneous activity of the giant neurone was augmented by the treatment with DDT, while at the higher temperature (27°C) no such augmentation was observed. Repetitive excitability of the giant neurone soma by DC stimulation was augmented by the treatment with DDT both at the lower

and the higher temperatures. Repetition of the second type was augmented markedly. Thus our assumption of the augmented repetitive excitability of neurone soma by DDT intoxication has been clearly demonstrated experimentally.

15. Studies on the mechanism of action of insecticides (X). Nervous activity as a factor of development of γ-BHC symptoms in the cockroach. Teruo YAMASAKI and Toshio ISHII (Botyu-Kagaku **19**, 106-112, 1954)

Effects of γ-BHC on the nervous system of American cockroach were investigated by oscillographic analysis in order to clarify the mechanism of development of γ-BHC symptoms.

The course of γ-BHC poisoning symptoms was as follows: latent period, period of excitation and ataxia, convulsive period, paralytic period, and death. Frequency of the spontaneous giant fibre impulses of the central nerve cord increased by BHC poisoning. Increase was most evident in the period of excitation and ataxia, and the activity decreased with advancement of symptoms. γ-BHC also affected the synapses, and the giant neurones elicited prolonged after-discharges by a single presynaptic cercal nerve volley. Such prolongations were most evident in the convulsive period. In the paralyzed roaches synaptic block, conduction block of the nerve fibre and the muscle paralysis were observed.

Thus the mechanism of development of γ-BHC symptoms in the roach can be clearly explained basing upon the present experimental results. It will be attributable to the slight synaptic facilitation that makes the roach during the period of excitation and ataxia hypersensitive to external stimuli, and the increased spontaneous activity of the nerve cord may present a suitable explanation for the hyperactivity of the roach. With advancing sypnaptic facilitation, coordinating function of synapse is so disturbed that the ataxia and even the convulsion may be induced. Further progress of poisoning depresses the spontaneous excitability of the nerve, thus inducing the immobility of the insect and the deteriorations of the nerve and the muscle, and as the result, the complete paralysis of the insect.

16. Studies on the mechanism of the expressions of the translucent and lemon genes in the silkworm. III. On the yellow pterins in the silkworm larva. Hisao ARUGA and Narumi YOSHITAKE (Journ. Seric. Sci. Japan **23**, 27-34, 1954)

Xanthopterin B which formerly had been considered to be a single compound was examined by paper chromatography using inorganic solvents as extension agents, and the obtained two distinguishable bands, denominated xanthopterin B-I and B-II, were observed.

Xanthopterin B-I is always present in lemon larva and is not found in normal ($+^{lem}$) strain, but xanthopterin B-II is found also in some normal strains. Every individual in which xanthopterin B-I is found always has xanthopterin B-II.

As products of photolysis of xanthopterin B some substances identical to those of folic acid were obtained, one of them being found to be 2・amino 4・hydroxypteridine 6・carboxylic acid.

Microanalysis using microorganisms showed that a substance which exhibits folic acid like activity was present in the extract solution from the integument of lemon larva, though it was not folic acid itself.

17. Studies on the mechanism of the expressions of the translucent and lemon genes in the silkworm. IV. On an enzyme acting on xanthopterin B in the silkworm, *Bombyx mori*. Hisao ARUGA and Shigemi KAWASE (Journ. Seric. Sci. Japan **23**, 99-107, 1954)

When xanthopterin B is incubated with the extract of the integument from normal ($+^{lem}$) larva, the yellow color and yellow fluorescence of xanthopterin B-I disappeared, and this action is scarcely recognizable when the extract of the integument from lemon is used. This phenomenon is not observed on xanthopterin B-II. The enzyme action observed in the larval integument of normal strain is also observable in the egg, moth, the adipose tissues of larva, body fluid, adipose tissues and genital organ of pupa of normal silkworm. But this action is not or scarcely recognized in the above mentioned tissues of lemon mutant. From several characteristics of this substance, it may be possibly supposed that this is a kind of enzyme.

In spite of the facts that in the Striped (p^s) and Striped-mottled lemon larvae xanthopterin B is scarcely formed in the integument containing melanin pigment, and also in od-translucent (*od*) and mottled-translucent lemon larvae this pterin is scarcely formed in the oily portion, above mentioned enzyme activity is very weak. So the expressions of p^s and *od* genes are thought to have effects of supressing the accumulation of xanthopterin B. This phenomenon may be caused by the difference of physicochemical conditions in the epidermal cells of such mutants.

Eggs of the normal moth at the stage of immediately after laying show this enzyme action, and the eggs of $+^{lem}/_{lem}$ derived from lemon mother moth show this enzyme action only from the stage of 17-18 hours after laying.

18. The mechanism on the manifestation of the crescent marking in the silkworm. Hisao ARUGA, Narumi YOSHITAKE and Eiichi NAGASHIMA (Journ. Seric. Sci. Japan **23**, 19-26, 1954)

The mechanism on the manifestation of the crescent marking of the silkworm has been investigated using various hybrids of several marking mutant strains. It has been ascertained that for the manifestation of the crescent, three factors must be considered: (1) the complex differentiation of the invisible anlage which is controlled mainly by the differentiation of the egg cytoplasm transmitted from mother moth to egg and by several gene actions acting on the processes of the formation of the epidermal cells of embryo, (2) the genes controlling the special crescent featured anlages of the epidermis, and (3) the genes expressing melanin pigments in the cuticle.

It has been ascertained that there are at least three kinds of genes, different in the mechanism of the expressions of the genes controlling the special crescent featured anlages of the epidermis, and the melanin formation in the cuticle of the crescent portion is not only controlled by $+^p$ gene, but also by some other genes.

19. Studies on the fluorescent compounds in some wild silkworms. I. On the fluorescent compounds in eggs of some wild silkworms. Hisao ARUGA, Narumi YOSHITAKE and Eiichi NAGASHIMA (Jap. Journ. Appl. Zoology **18**, 117-124, 1953)

Several fluorescent compounds in the eggs of some wild silkworms have been investigated in order to clarify the physiological significance of riboflavine and a few pterins, and the relation between those fluorescent compounds and the hibernating types of wild silkworms. The fluorescent compounds such as riboflavine,

3·hydroxykynurenine, kynurenine, leucopterin B (isoxanthopterin) and leucopterin had been identified in the silkworm, *Bombyx mori* L. at the various stages of developing eggs by paper chromatography.

(1) Through all stages of developing eggs, considerable quantity of riboflavine is recognized in all wild silkworms used in our experiments excepting *Dictyoploca japonica* in which a trace of riboflavine is detected.

(2) Although leucopterin B is discriminated at the early embryonal stage in *Bombyx mori* and *Bombyx mandarina*, it appears for the first time at the post developing stage in other wild silkworms excepting *Dictyoploca japonica*. It may be possibly thought that the presence of leucopterin B is closely related with the hardening and darkening of the integument of embryo, but has no relation to the hatching of the embryo.

(3) The mechanism of the phenomenon observed in our experiment, which showed that 3·hydroxykynurenine was not present in the eggs of wild silkworms excepting *Bombyx mandarina*, was discussed. In the eggs of *Dictyoploca japonica*, a few riboflavine and leucopterin B are present. It has been ascertained that there are some resemblances in the fluorescent compounds contained in the eggs between the wild silkworms which are intimately related with each other.

20. Studies on the fluorescent compounds in some wild silkworms. II. On the fluorescent compounds in larval integuments, pupae and moths of some wild silkworms. Hisao ARUGA, Narumi YOSHITAKE and Eiichi NAGASHIMA (Jap. Journ. Appl. Zoology **18**, 155-160, 1954)

(1) Considerable amounts of isoxanthopterin and leucopterin were observed in larval integuments of all wild silkworms, tested in the present experiment and the localization of those pterins in the integuments, were observed in some wild silkworms. Antherachrome I, II and III were observed in *Antheraea pernyi* and *Anheraea yamamai*.

(2) Most of the fluorescent compounds observed in pupae were present in the adipose tissues, Malpighian tubes, rectal sac and sebaceous gland. The adipose tissues contained kynurenine, 3·hydroxykynurenine, riboflavine and the same fluorescent compounds as in the integuments. And the changes in the quantities of these substances in these tissues during development were discussed.

(3) About ten fluorescent compounds were discriminated in the substances of rectal sac, but the differences in the kind of these compounds among different wild silkworms were observed. These compounds included all kinds of the fluorescent compounds observed in larval integuments and pupae.

(4) There were some differences in the different wild silkworms with respect to these compounds, and the differences had the close relation with the types of hibernation. Dictyochrome in *Dictyoploca japonica* and unknown fluorescent compounds in *Philosamia cynthia ricini* were observed, and the change of the quantities of these compounds and the natures of dictyochrome were described.

(5) It was ascertained that some resemblances of the kinds in fluorescent compounds contained in the larval integuments, pupae, substances in rectal sac and the secreted substances from sebaceous gland were recognized in the wild silkworms which are related with each other.

21. Biochemical studies on the voltinism in *Lepidoptera*. I. On the function of the voltinism determining hormone with special reference to the pigment formation in the serosa of the silkworm egg. Narumi YOSHITAKE (Journ. Seric. Sci. Japan **23**, 67-75, 1954)

The experiments on the function of the voltinism determining hormone which is thought to be secreted from the suboesophageal ganglion, especially of the pigmentation of the silkworm egg have been carried out. The result of the experiment concerning the quantitative estimation of 3·hydroxykynurenine, kynurenine, free amino acids, riboflavine and uric acid using nondiapause egg and diapause egg of the silkworm is summarized as follows.

	nondiapause egg	diapause egg
3·hydroxykynurenine	−	++
kynurenine	±	++
free amino acids	+	++
riboflavine	+	+
uric acid	+	+

As is shown in the Table, it has been ascertained that the voltinism determining hormone acts on the ovary or ovarian tubes, and give the ability to the transfusion of 3·hydroxykynurenine and kynurenine to the egg which are the precursors of the egg pigments being contained in pupa.

Such substances as 3·hydroxykynurenine, kynurenine and some free amino acids are influenced by the voltinism determining hormone in the process of the transfusion into eggs, but there are some substances as riboflavine which transfuse from mother moth to eggs without having relation to the voltinism determining hormone.

The nature of the hibernation and the existence of 3 hydroxykynurenine on the eggs laid by the moth of eri-silkworm, *Philosamia cynthia ricini*, in which the suboesophageal ganglia of the silkworm larvae had been implanted at pupal stages of 2-4 day after pupation have been investigated. The results have shown that the hibernation of the eri-silkworm egg was not influenced by the suboesophageal ganglia of the silkworm which had been implanted, and 3 hydroxykynurenine did not transfuse to the eggs.

II. Agricultural Chemistry

Abstract Nos. 22—77

22. Microbiological studies on the humification process. Part 1. Effect of microbes on the transformation of soil humus. Kenzo KÔBÔ and Yasuo TAKAI (Journ. Agr. Chem. Soc. Japan **27** (7), 445-448, 1953)

The authors investigated the effect of several microbes on the transformation of soil humus: 0.5 g of N/8 NaOH-soluble humus, or of N/8 NaF-soluble humus, was

mixed with 20 g of clean washed white sand in each respective flask and 14 cc of nutrient solution was added to it; after sterilizing, the flasks, in which the microbes were inoculated, were incubated at 30°C; during the period of incubation, the amount of CO_2 evolved was determined at several times and after a certain period the form of humus was examined by the SIMON method.

The results obtained were as follows:

(1) Under the conditions of this experiment, *Act. chromogenes*, *Act. unchromogenes*, *Pseudomonas fluorescence liquefascience*, *B. prodigiosus*, *B. mycoides* and *B. subtilis* showed no effect on the transformation of NaOH-soluble humus. But *Trichoderma konigni* and soil extract acted on the sample, produced a considerable amount of CO_2 gas, and after 74 days' incubation, the alkali extract of the sample resulted in an increase of the relative colour value (RF) and the precipitation quotient (PQ), and a decrease of the colour tone factor (TF). These show that the humification of the sample was promoted. Even in this case, however, there was no change in the form of precipitation of the humus extract (humus acid). On the other hand, the carbon-nitrogen ratio of the fulvic acid fraction of the *Trichoderma* plot was lowered to about a half of that of the *Actinomyces* plot or of the control plot. From these facts, it is acknowledged that the effect on humification is, in the first place, revealed in the transformation of fulvic acid fraction.

(2) NaF-soluble humus (mainly the true humic acid) was also acted on by *Trichoderma*, and after 38 days' incubation the relative colour value (RF) and the precipitation quotient (PQ) of the alkali extract became higher than that of the sample before the experiment. The true humic acid (die echte Huminsäure) is understood to be considerably stable to the microbiological activity, but, from the above facts, the true humic acid, especially brown humic acid, seems to be acted on by microbes if it is in the free state. The stability of the true humic acid in the soil may originate in forming the complex with inorganic colloids.

23. Microbiological studies on the humification process. Part 2. On the aerobic decomposition of the fresh plant residue, (a). Kenzo KÔBÔ and Yasuo TAKAI (Journ. Agr. Chem. Soc. Japan **27** (8), 477-480, 1953)

The humification process of fresh plant residues (upland-rice straw and chestnut-tree leaves) was pursued by estimating the amount of CO_2 evolved and humic character of alkali extract: 2 g. of dry powder of the sample was mixed with 20 g. of clean washed white sand in a 100 cc Erlenmeyer flask and 8 cc of nutrition solution ($(NH_4)_2HPO_4$ 10 g., K_2HPO_4 5 g., distilled water 600 cc) was added to it; after sterilizing, several pure cultured microorganisms, i.e. *Trichoderma konigni*, *Aspergillus niger*, *Actinomyces chromogenes*, *Pseudomonas fluorescence liquifacience*, and *Bacillus mycoides*, were separately incubated in each flask; in addition to it, we prepared one plot in which *Trich. konigni* had been incubated together with *B. mycoides*; then the flasks furnished with aeration tubes were incubated at 30°C.

The amount of CO_2 evolved was estimated at several times during the period of incubation, and after a certain period the humic character of alkali solution of decomposition products was examined by the SIMON method.

(1) When judged from the amount of CO_2 evolved in a certain period of time, it is assumed that in the decomposition process of upland-rice straw, *Trich. konigni* is most active as well as *Asp. niger*, and *Act. chromogenes* rather moderate, and *B.*

mycoides and *Asp. fluorescence* are not so active as others. The rate of CO_2 evolved by the microorganisms differed each other; *B. mycoides* and *Ps. fluorescence* liberated in the first two days of incubation about 60 per cent CO_2 evolved through the whole period of incubation; in the plot of *Trich. konigni* or *Act. chromogenes*, the maximum of CO_2 liberation came between the 4th day and the 9th day, but with *Asp. niger* the amount of CO_2 liberation decreased towards the end of the incubation period.

(2) A certain relation was also observed between the abundance of CO_2 and the formation of humus substance. On the basis of the amount of N/10 $KMnO_4$ solution consumed to oxidize 30 cc of alkali solution of decomposition product which had been formed during a certain period of incubation, it was found that *Ps. fluorescence* showed little increase in the formation of humus substance: *Trich. konigni* produced humus substance most abundantly among the microörganisms used, and *Act. chromogenes,* in spite of the fact that it liberated CO_2 much more than *B. mycoides,* was less active in humus formation than the latter, whose function of forming humus substance was next to that of *Trich. konigni.*

(3) In relation to the relative colour value (RF) of humus produced, *B. mycoides* was the most active in raising the value of that factor. In that activity *Act. chromogenes* was next, while *Trich. konigni* was inferior to the above two, and *Ps. fluorescence* show no increase in that value. *Asp. niger* ranked next to *Trich. konigni* in raising the relative colour value as well as in producing humus substance.

(4) The relative colour value of decomposition product was raised more by doubled inoculation with *B. mycoides* and *Trich. konigni* than by a single inoculation with *B. mycoides.*

(5) When the humifying action of fungus (*Trich. konigni*) is compared with that of aerobic bacteria (*B. mycoides*) from the above results, it will be assumed that fungus is superior to aerobic bacteria in the function of producing humus substance, but it is inferior in the function of promoting humification in the early stage of the incubation period.

(6) Under the conditions of this experiment, the products of humification was obtained in higher degree in a short period of time, with chestnut-tree leaves as a starting material rather than with upland-rice straw, the reason for which will be explained later.

24. Microbiological studies on the humification process. Part 3. On the aerobic decomposition of the fresh plant residue, (b) Absorption spectra of decomposition products. Kenzo Kôbô and Yasuo Takai (Journ. Agr. Chem. Soc. Japan **27** (8), 481-485, 1953)

The humification process of fresh plant residues, upland-rice straw and chestnut-tree leaves, by means of pure cultured microörganisms was pursued by estimating absorption spectra of alkali solution of decomposition products. The plan of this experiment was the same as in the previous reports, but in this experiment we used *Trichoderma konigni* and *Bacillus mycoides*; in one plot these microörganisms were separately inoculated in each flask, and the other plot they were inoculated with them together. The amount of CO_2 evolved, the Simon's value and absorption spectra of alkali solution of decomposition products, were estimated at several intervals during the course of incubation. The results obtained were as follows:

(1) *B. mycoides* was inferior to *Trich. konigni* in producing humic substance,

but it was superior in raising the degree of humification in the early stage of incubation process. These facts were shown by the amount of N/10 $KMnO_4$ solution consumed to oxidize a definite quantity of alkali solution and absorption coefficient of the alkali solution of decomposition products. The degree of humification was raised much more by doubled inoculation with *Trich. konigni* and *B. mycoides* than by a single one.

(2) Along with the decomposition of the sample, the absorption coefficient of alkali solution of decomposition product was raised for all wave lengths; the peak of absorption disappeared near 330 mμ, and the depression near 265 mμ inclined to get less deep. The maximum of absorption near 330 mμ, which was estimated in the early stage of humifisation, was derived from the fulvic acid fraction and seemed to disappear when the precipitation quotient (PQ) was raised more than 55 in the course of decomposition of upland-rice straw. As the maximum of absorption near 265 m/d is characteristic of lignin, the flattening of this depression shows the degeneration of lignin with the progress of humification.

(3) More highly humified substance was obtained from chestnut-tree leaves than from upland-rice straw. This is supposed to come from the fact that the sample of chestnut-tree leaves has been in a little humified state.

25. Dynamic studies on the nutrient uptake by crop plants (Part 7). The effect of butyric acid and respiration inhibitors such as H_2S, NaCN and NaN_3 on the nutrients uptake by rice plant. Shingo MITSUI, Kikuo KUMAZAWA and Tatsuo ISHIWARA (Journ. Sci. Soil and Manure Japan **24**, 45, 1953)

The inhibition of nutrient uptake by rice plant was studied by increasing concentrations of butyric acid or respiration inhibitors such as H_2S, NaCN and NaN_3.

Rice plants were grown by customary water culture technique and treated for 28 hours in the greenhouse with various concentration of these inhibitors in the basic nutrient solution.

In general, the relationship between the nutrient uptake and the concentration of inhibitors can be represented by

$$y_i = a_i + b_i e^{-c_j x_j}$$

where y_i represents nutrient uptake, x_j the concentration of inhibitors, i and j being variables according to the kind of elements and inhibitors respectively. a_i represents y_i at $x_j \to \infty$ and was designated as ultimate absorption. Further, the inhibition coefficients of nutrient uptake were calculated by

$$\frac{(y_i(x_j \to 0) - y_i(x_j \to \infty))}{y_i(x_j \to 0)} \times 100$$

The ultimate absorption a_i seems to be almost independent of the kind of inhibitors but primarily dependent on the kind of elements. The inhibition coefficients decreased according to $K_2O \cdot P_2O_5 > SiO_2 \cdot SO_3 \cdot Br > MnO \cdot NH_4\text{-}N \cdot H_2O > MgO \cdot CaO$.

The result was discussed on the basis of the essential mechanism of aerobic respiration, K_2O and P_2O_5 probably linking more directly in the metabolic cycle and MgO and CaO standing more indirectly or far apart from the cycle. Practically, this will give important suggestion to the improvement of the nutritional status of the crop plants in such cases as the metabolic activity of their roots are inhibited by toxic substances (for example H_2S and butyric acid to rice plant), cold climate, draught or bad drainage.

26. Studies on nitrogen metabolism of rice plant with use of isotopically labelled ammonium sulphate. Part 3, 4. Kiyoshi OZAKI, Masaaki MORIYAMA and Shingo MITSUI (Journ. Sci. Soil and Manure Japan **23**, 169, 237, 1953)

After culturing with nutrient solution until the panicles begin to grow, rice plants were supplied with $(N^{15}H_4)_2SO_4$. Plants were harvested 12, 24 and 48 hrs. after the application of labeled salt to detect certain details of the course of assimilation of this nitrogen.

Of each harvested plant, nitrogenous compounds were separated from leaves, stems and roots, and analyzed for their concentration of N^{15}.

Rapid absorption, translocation, and utilization of the ammonium nitrogen were found to have occurred after 12, 24 and 48 hrs. The concentration of N^{15} of water soluble compounds was always higher than that of protein.

Of water soluble non-protein compounds N^{15} was as amide > acidic amino acid > neutral amino acid; of protein it was as amide > acidic amino acid > humine > neutral amino acid > basic amino acid.

The incorporation of N^{15} into water soluble non-protein compounds was able to be accounted for as a result of sytnhesis of these compounds during experimental period, but the incorporation of N^{15} into protein was apparently the result of continuous exchange reaction.

The assimilation of ammonium nitrogen was concluded to proceed as follows: NH_4–N was easily converted to amide and acidic amino acid which directly entered into protein; on the other hand, some nitrogen was changed into neutral amino acids and other water soluble compounds and then entered into the protein molecules.

27. Studies on nitrogen metabolism of rice plant with use of isotopically labelled ammonius sulphate. Part 5. Kiyoshi OZAKI, Masaaki MORIYAMA and Shingo MITSUI (Journ. Sci. Soil and Manure Japan **24**, 209, 1953)

In a series of nitrogen fertilization study of rice plant, the authors found that the quantity of protein in rice was increased even by more than ten per cent by the nitrogen application at shooting time although the grain yield was not altered. The effect of this nitrogen application was mainly on the increase of oryzenine, which is the main stored protein in white rice.

This study was advanced by means of stable isotope of nitrogen.

Nitrogen was given to rice plant at it's shooting as $(N^{15}H_4)_2SO_4$ and the brown rice, harvested at full mature, was divided into three parts: embryo, bran and endosperm and further five protein fractions were separated from endosperm.

The concentration of N^{15} was as follows: embryo > globline, oryzenine and insoluble protein in endosperm > bran > albumine and prolamine in endosperm. It should be emphasized that N^{15} concentration of prolamine and albumine in the endosperm were lower than that of any other parts.

28. Dynamic studies on the nutrients uptake by crop plants. Part 8. The reducing power of the root of growing rice plant as revealed by the soil leachate. Shingo MITSUI and Kiyoshi TENSHO (Journ. Sci. Soil and Manure Japan **24**, 145, 1953)

Complimentary to the results reported in Parts 3 and 4 the authors studied the effect of oxido-reductive power of the growing rice plants on the leaching down of

soluble organic matter in the soil leachate as revealed by acid-permanganate consumption.

The increase of the leached organic matter in the planted plots as against the non-planted plot in the later half period of rice growth was outstanding in the soil of the degraded type (Hiroshima soil) in combination with the application of the sulfate-fertilizers. In the normal (Tamagawa soil) or well buffered soil (Tanashi soil) the effect was far less.

Generally concluded, the leaching down of organic matter from the waterlogged soil should be apprehended on the dynamic interaction of the nature of the soil, kind of fertilizers applied and of the root activity, particularly its oxido-reductive power.

29. Studies on interaction of vitamin B_1 disulfide and Pantetheine. Yoshikazu SAHASHI, Saburo FUNAHASHI, Kyohei YAMASHITA, Masateru MIYANO and Tadami AKAZUKA (Vitamin **6**, 839, 1953; Journ Biochem. Japan **41**, 463, 1954)

In the previous paper, the authors stated studies on interaction of vitamin B_1 and sulfhydryl group in protein. In 1951, SNELL reported studies on Paper chromatography of pantetheine-cysteine system. Recently, the authors have attempted studies on paper chromatography of B_1-S-S-pantetheine system. Interaction of vitamin B_1 disulfide and freshly prepared pantetheine also seems to produce B_1-S-S-pantetheine mixed disulfide as follows:

	B_1	B_1-S-S-B_1	B_1-S-S-pantetheine	pantetheine
R_F value	0.32	0.45	0.64	0.88

Solvent: BuOH:AcOH:H_2O 4:1:1

30. Biochemical studies on vitamin B_{12} (continued), biosynthesis of vitamin B_{12} in domestic ducks. Yoshikazu SAHASHI, Kiichi IWAMOTO and Junzo HAYASHI (Vitamin **6**, 686, 972, 1953; Journ. Vitaminology **1**, 39, 1954)

In 1952, the authors stated the relation between vitamin B_{12}-nutrition in poultry and the vitamin B_{12}-forming microbes. Recently, the authors have studied this problem in water-fowls-domestic ducks and found the occurrence of vitamin B_{12}-forming microbes in every part of the digestive tract. Further confirmation was carried out by several intensive experiments with Co^{60}-labelled $CoCl_2$. Co^{60}-labelled vitamin B_{12} was found in all alimentary tract of the animals administrated with $Co^{60}Cl_2$ per os and more over the form of Co^{60}-containing compounds in the liver may be Co^{60}-labelled vitamin B_{12}.

31. Studies on vitamin B_{12}-Complexes in blood-serum. Yoshikazu SAHASHI, Kichi IWAMATO and Junzo HAYASHI (Vitamins (Japan) **7**, 602, 1954)

Recently, it appeared in a few reports that various proteins bind vitamin B_{12}. These included not only a concentrate of gastric mucosa, but also globulin fractions from blood. Therefore, the authors carried out further repeated investigations on this problem by the dialysis method based on the nondializability of vitamin B_{12}-complex and by the paper electrophoretic patterns. B_{12}-complexes in blood-serum was confirmed to be combined with γ-globulin.

32. Effect of vitamin B_{12} on energy metabolism II. Yoshikazu SAHASHI, Kiichi IWAMOTO and Junzo HAYASHI (Vitamins (Japan) **7**, 470, 1954)

In 1953, the authors reported that vitamin B_{12} may be essential to energy metabolism from the variation of vitamin B_1 and B_{12} in blood effected by energy work. Recently, the same authors tested the ratio of pantothenic acid conjugate/total pantothenic acid and nicotinic acid conjugate/total nicotinic acid in various tissues by chicks fed on a vitamin B_{12}-deficient diet. Low value in liver and blood were observed in vitamin B_{12}-deficient chicks, but, on the contrary, normal animals always indicated favourable results.

33. Micro-chemical determination of vitamin A, II. Yoshikazu SAHASHI, Fumio SAITO, Masanobu YOSHIDA, Akihiko NAKAYAMA, Kano MIYAZAKI, Keiji HARASHIMA and Hideo IWAMOTO (Vitamins (Japan) **6**, 692, 847, 974, 1953; **7**, 308, 483, 692, 1954)

In the previous papers, the authors reported several experiments by BESSAY method with various home-made materials. Afterwards, the method was repeatedly tested for determination of vitamin A in blood-serum preserved at 0° for 140 hrs., determination of β-carotene in blood, studies on absorption-coefficient of vitamin A, studies on appearance in blood of vitamin A by vitamin A-deficient rats administered with β-carotene per os, and various kinds of applications. The results were briefly summarized in the present communications.

34. Determination of end group in the polysaccharide produced by the action of isoamylase. Tsuneo KOBAYASHI and Makoto KADOWAKI (Journ. Agr. Chem. Soc. Japan **27**, 599-602, 1953)

The end group assay was carried out with periodate oxidation method on several starch-type polysaccharides, and average number of glucose residue per non-reducing end group was calculated from the amount of formic acid liberated after 25 hours of oxidation by 0.037 *M* sodium metaperiodate at 0°C. The following values of average chain length were obtained: soluble potato starch 29.5, potato amylopectin 26.3, potato amylose 480, soluble glutinous-rice starch 18, and polysaccharide produced from glutinous-rice starch by the action of isoamylase 100 ± 5. The value for the product of isoamylase approximately coincided with values of average polymerization degree, formerly estimated with viscosimetry or osmometry.

From the above result the authors have confirmed KOBAYASHI's theory that the isoamylase produces amylose-type polysaccharide from amylopectin-type polysaccharide as previously reported.

35. Studies on dextran. IV. Dextran-destroying enzyme of molds. Tsuneo KOBAYASHI (Journ. Agr. Chem. Soc. Japan **28**, 352-7, 1954)

Penicillium purpurogenum var. *rubri-sclerotium*, *P. funiculosum*, and *P. lilacium* produced a powerful dextran-destroying enzyme (dextranase), when they were cultured in the presence of dextran; but a slight enzyme activity was detected in the molds cultured without dextran. The dextranase rapidly reduced the viscosity of dextran solutions, and gradually increased the reducing power. The reciprocal of the specific viscosity ($1/\eta_{sp}$) changed linearly with time, showing that the enzyme split all the α-1,6-glucosidic linkages in dextran in the same probability. The increase in the reducing power became slower as the reaction proceeded, and practically stopped

at a point corresponding the degree of hydrolysis above 50-60%. The conversion limit was higher with increasing amount of the enzyme. The ultimate degradation products detected were isomaltose and isomaltotriose (dextrantrisaccharide). The dextranase was most active at a pH between 5.25-6.5, destroyed by heating at 60°C for 5 minutes, and inhibited by $HgCl_2$, $AgNO_3$, $CuSO_4$, or I_2.

The resemblance in their mode of hydrolyzing polysaccharides was pointed out between dextranase and starch-liquefying amylase; both enzymes produced fission products of relatively high molecular weights in the first stage of the reaction. But the fission products by dextranase were liberated in the β-configuration, showing a marked contrast to the products by starch-liquefying amylase, which were split in the α-configuration.

36. **Studies on chemical reaction by a high frequency oscillator. 4. A capacitive relay for a fraction collector.** Tetsuro KÔNO (Journ. Agr. Chem. Soc. Japan **27**, 521-3, 1953)

A relay was designed which was operated by the change of dielectric constant. A coaxial condenser was connected parallelly with the tuning circuit of a crystalline oscillator, and the grid of the oscillator was connected to the grid of another vacuum tube which was used as a vacuum tube relay. When the tuning circuit was syntonized, the relay was opened because the grid bias was caused by the oscillation. But when a liquid, say water, was flown in the coaxial condenser, the capacity of the tuning circuit increased enough to break off the sytony and stop the oscillation, which made the relay to operate because the grid bias was disappeared. The relay worked stably and surely even by the liquids of low dielectric constants, such as benzene or ligroin. The coaxial condenser was set on a siphon and the relay was used to move a turntable of a fraction collector.

37. **Studies on chemical reaction by a high frequency oscillator. 5. High frequency titrations of organic acids.** Tetsuro KÔNO and Makoto ISOYA (Journ. Agr. Chem. Soc. Japan **27**, 708-12, 1953)

High frequency titration of weak acids was examined with a new apparatus composed of two oscillators, of which one was an usual high frequency titration apparatus, and its plate voltage was compared with that of the another oscillator which was used as a control. Though MATSUI and KAMURA (J. Pharm. Soc. Japan 71, 1194, 1951) claimed that when weak base such as pyridine or quinoline was added to aqueous solutions of weak acids, the latter of pKa up to 7 could be titrated with NaOH, the authors showed that the use of collidine instead of pyridine was much preferable to perform accurate titrations. The also showed that when pyridine was used, the weak acids of pKa up to 6 could be titrated with Na_2CO_3 without any consideration of blank value. N/100 Na_2CO_3 behaves as N/200 Na_2CO_3 in this titration. Fatty acids in oil could not be titrated as above in alcoholic soln. or in aqueous suspension, but they could be titrated in 50 v.% alcohol with the help of collidine and Tween 60.

38. **Determination of the sulfate in sulfite waste liquor by the high frequency titration.** Eizo NOKIHARA, Ryuzo TANAKA and Tetsuro KÔNO (Journ. Agr. Chem. Soc. Japan **28**, 409-13, 1954)

When the sulfate in the sulfite waste liquor was titrated by the conductometric titration with $BaCl_2$, it was observed that the sensitivity of the titration was often

lowered owing to the sedimentation of $BaSO_4$ on the cell. This trouble was overcome by using the high frequency titration. A bridge-type apparatus as was shown in the previous report was used. A frequency of 20 Mc. and a special pipette-type-cell was used in the titration to perform the titration sesnitive in the pulp waste liquor which contained sufficient amount of sulfite.

39. An electronically controlled combustion apparatus for the micro determination of carbon and hydrogen. Tetsuro KÔNO, Setsuko SHIMOKÔBE, Michiko NAKAYAMA, Mitsuko OGATA and Takeko MITSUI (Japan Analyst **3**, 224-8, 1954)

A new automatic apparatus for the Pregl's micro determination of carbon and hydrogen was described. The moving furnace, 8 cm. long, was moved 13 mm./min. by a synchronized motor, but it was stopped by a relay whenever the pressure in the combustion tube was increased. Thus, the furnace did not move until it was heated to the maximum temperature, and it was stopped also when the sample was evaporated or oxidized. Therefore the sample was burnt not rapidly but gradually, according to its nature and quantity. The relay was composed of a fine capillary and a manometer which contained a 33% KOH solution. Analytical data on test samples were satisfactory, and the data given by this apparatus on 100 unknown samples showed good coincidence with that given by the usual apparatus and skilful analysts.

40. Paper chromatography of phosphoric esters. Takao OHMURA and Sadao FUKUSHI (Journ. Agr. Chem. Japan **27**, 516, 1953)

Phosphoric esters were separated with paper chromatography using seven solvents under room temperature. Washing of paper with acid and removal of cations from test samples were necessary to avoid tailings or ghost spots. Phosphorylated products of oxidative phosphorylation of mung bean particles were separated two-dimensionally.

41. Studies on the Ba-fractionation of phosphorylated compounds. Takao OHMURA (Journ. Agr. Chem. Japan **28**, 240, 1954)

Quantitative fractionation of phosphorylated compounds with Ba at pH 8.2 were examined using labelled phosphoglycerate (P*GA) and fructose diphosphate (FDP*). FDP* and P*GA, when added to the trichloracetic acid extracts of rat liver or rat muscle were recovered from Ba-insoluble fractions with recoveries of only 60 and 40%, respectively.

42. The syntheses of peptides by the phthaloyl method. Part 1. Condensation of phthalimidoacyl chloride with amino acid ester. Kyohei YAMASHITA, Hachiro WAKAMATSU and Yoshikazu SAHASHI (Journ. Agr. Chem. Soc. Japan **27**, 649-52, 1953)

The authors modified the phthaloyl method for the synthesis of phthaloyl dipeptide esters. Phthalimidoacyl chloride and amino acid ester readily reacted to give corresponding phthaloyl peptide ester. Without any reagent for the removal of hydrogen chloride produced during the condensation, the reaction proceeded smoothly. By this method the authors synthesized esters of following phthaloyl peptide; phthaloylglycylglycine, -glycyl-DL-alanine, -glycyl-L-leucine, -DL-alanyl-glycine, -DL-alanyl-DL-alanine, -DL-alanyl-L-leucine, -L-leucylglycine, -L-leucyl-DL-alanine, -L-leucyl-L-leucine.

By the hydrazinolysis of these phthaloyl peptitde esters after saponification with dilute alkali the authors readily obtained corresponding peptides. Procedure is given for the synthesis in a high yield of glycyl-L-leucine.

43. The effect of protein on the preservative quality of condensed skimmilk. I. The effect of the protein denatured by heating at high temperature. Tomokichi TSUGŌ (Jap. Journ. Zootech. Sci. 24, 1, 1953)

The keeping qualities were tested on the sweetened condensed skimmilk produced from skimmilk of which a part of protein had been denatured by heat at a laboratory scale. It was found that the condensed skimmilk resulted to be not-coagulable to some degree when a part of skimmilk was heated for relatively longer time at above 110°C. However, in this case the condensed milk showed a brown appearance.

When the heating conditions were in such a range of temperature and time as the product never assumed a brown color, it was not able to improve the keeping quality of the product by heat denaturation.

II. The effect of sodium caseinate. Tomokichi TSUGŌ (Jap. Journ. Zootech. Sci. 24, 4, 1953)

In order to remove the defect of sweetened skimmilk that is more coagulable than wholemilk product, sodium caseinate was added to skimmilk and the mixture was condensed at a laboratory scale. The keeping quality tests were performed on the condensed product.

It was found that a considerable stabilizing effect was already shown in the case of 0.5 per cent addition of sodium caseinate as solid to skimmilk, while in the case of 1 per cent addition of sodium caseinate a satisfactory effect was secured, and the condensed product became very stable.

Furthermore, a condensing experiment was performed at a commercial scale, and it was confirmed that the addition of sodium caseinate resulted to prevent the coagulation of the condensed product satisfactorily.

According to the result of this study, it was considered that the effect of addition of sodium caseinate consisted not only in increasing the solid of skimmilk and improving the sugar ratio of the condensed product, but also in stabilizing the condensed product to a hardly coagulable form when the added amount reached above a certain degree.

III. The effect of soy-bean protein. Tomokichi TSUGŌ (Jap. Journ. Zootech. Sci. 24, 8, 1953)

Soy-bean protein was extracted from defatted soy-bean meal with sodium hydroxide, and then separated by being precipitated with acid. The sodium hydroxide solutions of the soy-bean protein were added to skimmilk in place of sodium caseinate as in the previous report, and the condensing experiments were performed.

The results showed that the addition of 0.5% soy-bean protein solid to skimmilk, was the most suitable from the point of view of viscosity, appearance and stability of the condensed product.

In the next experiments using whole milk in place of skimmilk, it was confirmed that the addition of 0.5% soy-bean protein solid exhibited the most stabilizing effect on the condensed product as in the above experiments.

44. Experiments on the condensing of whole milk and whey mixed with soy-bean milk. Tomokichi TSUGŌ (Jap. Journ. Zootech. Sci. 24, 73, 1953)

When soy-bean milk was mixed with cow's milk and the mixture was condenced,

the viscosity of the concentrate became higher due to the protein of soy-bean milk.

The results of various condensing experiments showed that the most satisfactory rate of mixing soy-bean milk (containing 6.3% solids) with cow's milk was 0.16-0.24:1.

The results of condensing experiments of soy-bean milk with various wheys were as follows: in the case of rennet whey, whether in itself or neutralized, mixing treatment was easy, and the condensing product had the best flavor. In the case of hydrochloric or lactic acid whey, it was needed to prevent the precipitation of soy-bean protein by means of neutralizing and then heating these wheys, turning the soluble calcium salts into the insoluble and removing the precipitate.

These products were not same as the usual condensed milk in the chemical composition, but since the products had similar appearance and consistency as the latter, they might be used as similar food.

45. The manufacture of synthetic milk powder from whey and soy-bean. I. The preparation of synthetic milk from whey and soy-bean. Rinjiro SASAKI and Tomokichi TSUGŌ (Jap. Journ. Zootech. Sci **24**, 105, 1954; Intern. Dairy Congr. Proc. 13th. **4**, 602, 1953)

As the basic experiment for the preparation of synthetic milk from whey and soy-bean, soy-bean milk was prepared from soy-bean, and conditions were determined for mixing it with various wheys so that no coagulation of soy-bean protein occurred. On the basis of these results, experiments for the preparation of synthetic milk were carried out by grinding soy-beans soaked in water, adding whey to the ground soy-beans, heating the mixture and removing the insoluble residue by press filtering.

By this method the amount of extracted solid was 5-10% less than that in the case of mixing soy-bean milk obtained by treating with water alone and whey, but it was advantageous from the point of view of simplifying the process. Lactic acid whey and cheese why were used in these experiments, and as regards flavor and yield of the synthetic milk, cheese whey was preferable to lactic acid whey. However, in lactic acid whey, the resulting product had a much better flavor compared with soy-bean milk itself.

II. The manufacture and nutritive value of the synthetic milk powder. Rinjiro SASAKI and Tomokichi TSUGŌ (Jap. Journ. Zootech. Sci. **24**, 108, 1954; Intern. Dairy Congr. Proc. 13th. **4**, 606, 1953)

On the basis of previous work, a manufacturing experiment was carried out at a milk powder factory to prepare synthetic milk powder, similar to whole milk powder, from whey and soy-bean, to standardize the composition by adding cream to the synthetic milk and to dehydrate the liquid milk by the spray drying process.

A comparision of some properties of the synthetic milk powder with those of ordinary whole milk powder as a control gave the following results:

(1) Appearance; the product had a rather deeper colour than the control, being somewhat brownish yellow;

(2) Flavour; the product had a slight soy odour and a sweeter and richer taste than the control powder;

(3) The chemical composition of the product is almost the same as that of the control powder, but the digestible protein content, the solubility and the contents of certain vitamins are lower than those in the control powder.

On the basis of the chemical composition it was assumed that the product consists of 55 parts of milk solids (whey solids 37 + milk fat 18) and 45 parts of soy-bean milk solids.

Tests on keeping quality showed that the product is more hygroscopic than the control powder but is less subject to changes of flavour than the latter, the production of oxidized flavour in particular occurring much more slowly.

A comparision of the nutritive value by animal feeding tests using albino rats showed that the nutritive value of the product was not inferior to the control powder. Further, satisfactory results were obtained using the product as infant food.

It was therefore concluded that the synthetic milk powder obtained from whey and soy-bean was practically equivalent to ordinary whole milk powder with respect to the chemical composition and nutritive value, and could be used in practice in pace of the latter.

46. Studies on the production of diacetyl by lactic acid bacteria. Rinjiro SASAKI, Tomokichi TSUGŌ, Tsuneaki IMAMURA and Muneaki MURAI (Jap. Journ. Zootech. Sci. **24**, 176, 1954; Intern. Dairy Congr. Proc. 13th. **4**, 611, 1953)

Results obtained in this study are summarized as follows:

In spite of the occurrence of a slight inhibition of bacterial growth resulting from the addition of 0.15% of citric acid, diacetyl production was accelerated.

Shaking the culture had more effect on the diacetyl production and also on the inhibition of bacterial growth than the addition of citric acid.

Lactose addition had more effect on the diacetyl production than glucose and galactose, but was inferior to the latter in practice. The order of effectiveness was as follows: lactose > galactose > glucose.

The addition of $CaCO_3$ did not have much marked effect in inhibiting the reduction in the diacetyl content of the medium.

Diacetyl production by *Str. lactis* was the highest at 20°C and the order of effectiveness was as follows: 20°C > 30°C > 10°C.

47. Studies on the chemical changes of milk components produced by *Penicillium Roqueforti.* I. Changes in milk fat. Tsuneaki IMAMURA and Tomokichi TSUGŌ (Intern. Dairy Congr. Proc. 13th. **4**, 622, 1953)

Studies on the changes of milk fat by *P. Roqueforti* and its enzyme extract were carried out. The results obtained are summarized as follows:

Accumulation of volatile fatty acid was almost not observed in media which contained no sugars as the mould utilized the fatty acid as carbon source.

Marked fat hydrolysis by the mould took place after 20 days incubation. This period is necessary for the secretion of the fat-hydrolysing enzyme from the mould body. The production of ketones by the mould was determined and 176.7 to 199.5 mg of ketone was found to be produced.

The fat-hydrolysing activity of the enzyme extract of *P. Roqueforti* was highest over the range pH 5 to 6 and at 37°C. The activity was maintained for 3 days and declined gradually after this.

The lower the molecular weight of the fatty acid, the more the fatty acid decomposed. This would appear to explain the accumulation of insoluble volatile fatty acids in Roquefort cheese.

48. Studies on the volatile fatty acids produced by *Pencillium Roqueforti* from cheese curd. Tomokichi TSUGŌ and Tsuneaki IMAMURA (Journ. Agr. Chem. Soc. Japan **27**, 838, 1953)

Changes of volatile fatty acids in whole milk curd, skim milk curd, goat's milk curd and cream inoculated with *P. Roqueforti.* and/or *Str. lactis,* were experimented. Quantitative determination of volatile fatty acids was done by modified DUCLAUX's method. Results obtained were as follows:

(1) The total amount of volatile fatty acids in incubated whole milk curd was lower than that of commercial Roquefort cheese.

(2) By addition of mercerated bread which was previously incubated with *P. Roqueforti* before hooping, volatile fatty acids were produced more than usual inoculation.

(3) Volatile fatty acids were produced more in goat's milk curd than in cow's milk curd.

(4) By *Str. lactis,* production of volatile fatty acids was slight, and caproic, caprylic and capric acids were not produced.

(5) Lower volatile fatty acids were produced from lactose in skim milk curd and the amount of fatty acids decreased after lactose were decomposed by *P. Roqueforti.*

(6) Higher volatile fatty acid, as well as lower acids, were produced from cream, but total amount of volatile fatty acids was lower than that of skimmilk curd at the beginning of incubation period.

(7) Most of the volatile fatty acids were in the form of salt and those in ester form were acetic and butyric.

49. Studies on the determination of vitamin A and carotene in butter. Rinjiro SASAKI, Tomokichi TSUGŌ and Susumu KOYAMA (Intern. Dairy Congr. Proc. 13th. **4**, 645, 1953)

A simple method of carotene determination is described. This method, although very simple, suffers from the defect that all the carotenoids in butter are calculated as β-carotene. Since β-carotene accounts for more than 90% of the total carotenoids, it is considered that the error is not so large.

The total vitamin A (vitamin A+carotene) in Japanese butter has been determined and during the four seasons of the year vitamin A potency was highest in autumn and lowest in winter.

50. Quantitative determination of riboflavin in milk products by electronic photofluorometer. Rinjiro SASAKI, Tomokichi TSUGŌ, Masao FUJIMAKI and Satoru OKA (Journ. Agr. Chem. Soc. Japan **28**, 20, 1954)

Fluorometric determination of riboflavin in milk products by electronic photofluorometer was studied.

The conditions for photolysis of riboflavin in milk products were examined, and both from quantities of riboflavin added to deproteinized solution of milk products and from readings measured after photolysis, regression line was obtained by the application of methods of least squares.

Mean regression coefficient and estimated error with 5% of significant level obtained from measured samples of 188 were found to be 171.800 and 3.59. So the

relation between reading in photofluorometer $\hat{X}$ and content of riboflavin Y was shown by the following equation.

$$\hat{X}=\frac{Y}{171.800}=0.00582072\,Y$$

From the results of experiments, our method of determination of riboflavin in milk products by electronic photofluorometer is presented in this paper, and it was found to be well available for its determination.

Contents of riboflavin in some Japanese milk products were also determined.

51. The stability of ascorbic acid in milk subjected to heat treatment. Rinjiro SASAKI and Kageaki AIBARA (Intern. Dairy Congr. Proc. 13th. 4, 637, 1953)

The stability of added ascorbic acid in milk was studied under various conditions. In particular, the influence of heat treatment under reduced pressure and of the lactic acid fermentation upon the stability of the acid was investigated.

De-aeration appeared to be effective not only in preventing the decomposition of ascorbic acid during the heating process but also in stabilizing the acid in storage.

Lactic acid fermentation did not show any direct correlation to the content of the ascorbic acid in milk.

52. On the emulsification of edible fats and oils. Rinjiro SASAKI and Susumu KOYAMA (Journ. Oil Chemist' Soc. Japan 3, 13, 1954)

The emulsifying abilities of various fats and oils, and emulsifying effects of various emulsifiers on these fats and oils were studied. For the determination of emulsifying powers both colorimetric and distillation methods were tested. The latter was found to be more convenient. The following results were obtained.

(1) Hydroxyl values of fats and oils increased in proportion to their emulsifying abilities.

(2) Unless fats and oils were oxidized, there was no difference between emulsifying abilities of saturated and unsaturated fats and oils.

(3) Sodium-caseinate and unsaponified fraction of lanolin (m.p. 67-78.5°C) were found to be excellent emulsifiers.

53. On the emulsification of butter fat. Rinjiro SASAKI and Susumu KOYAMA (Journ. Oil Chemist' Soc. Japan 3, 16, 1954)

The effects of butter components on the emulsification of butter were studied. Casein prepared from skimmilk, albumin and globulin from duck egg and purified lecithin from soy-bean were added to butter fat in the order and emulsifying powers of these components were determined by distillation method. It was found that the texture of butter was affected by the emulsifying effects of these components. Albumin was most effective.

54. The inhibition of the milk-coagulating enzymes by blood serum. Tomokichi TSUGŌ and Kunio YAMAUCHI (Intern. Dairy Congr. Proc. 13th. 4, 641, 1953)

The inhibitory action of blood serum on coagulation of milk by rennin is specific to the sort of animals. Sera of pig and horse are comparatively strong. The data were obtained mainly by using diluted horse serum. The inhibitor is considered to be a protein or protein-like substance from its ianctivation by heat (65-70°C) and by

various reagents such as alcohol, formalin, acetone and mercuric chloride. Although it is not clear in which fraction of the serum it is present, the fraction precipitated by 0.4-0.5 saturation with ammonium sulfate shows the strongest inhibitory action. This inhibitor is absorbed by active earth.

It inhibits most strongly when milk is coagulated by rennin. This inhibitory action seems to be due to its immediate action on rennin as a clear quantitative relationship is observed between serum and rennet when both are mixed and kept before adding to milk in order to allow the reaction to complete by itself.

Rennin probably combines with this inhibitor and is then inactivated.

Thrombin, the blood-coagulating enzyme, does not clot milk nor does rennin fibrinogen. Only papain coagulates both casein and fibrinogen.

55. A rapid micromethod for determining calcium in milk. Tomokichi TSUGŌ and Shuryo NAKAI (Sci. Animal Products **4**, 139, 1954)

A rapid micromethod for determining calcium in milk is estimated. According to this method, 0.5 cc of milk is digested with 1 cc of mixed acid consisting of perchloric and nitric acids (1:1), and calcium, precipitated as oxalate, is centrifuged, washed, and then titrated by 0.005 N potassium permanganate solution.

This method is very accurate and comparatively fast.

56. On the coagulation of cow's milk and bean milk by acids and salts. I. Comparison of cow's milk with soy-bean milk. Tomokichi TSUGŌ (Journ. Jap. Soc. Food and Nutrition **6**, 111, 1953)

Soy-bean milk extracted from ground bean meal with boiling water was compared with cow's milk, regarding the coagulability by lactic, hydrochrolic acid and various calcium salts.

The minimum amounts of acids (2N) and calcium salts (anhydrous) which were required to coagulate 10 cc of soy-bean milk (dry matter 7.50%) were as follows: HCl 0.55 cc; lactic acid 0.50 cc; $CaCl_2$ 10.8 mg (Ca 3.9 mg); Ca-lactate 24.3 mg (Ca 4.5 mg); $CaSO_4$ 37.0 mg (Ca 10.9 mg). However, controlling the pH of soy-bean milk up to 6.8, no coagulation occurred.

Cow's milk was not coagulated by addition of such a amounts of acids and salts.

Therefore, cautious treatment is required to keep the same stability of soy-bean milk in long period as that of cow's milk.

II. The comparision of cow's milk with peanut milk. Tomokichi TSUGŌ (Journ. Jap. Soc. Food and Nutrition **6**, 151, 1953)

The coagulation test showed that peanut milk was more coagulable than soy-bean milk by acids or calcium salts.

57. Comparision of the digestive action of rennet with pepsin on cow's milk and soy-bean milk. Rinjiro SASAKI, Tomokichi TSUGŌ and Satoshi ODAGIRI (Journ. Jap. Soc. Food and Nutrition **6**, 154, 1953)

Soy-bean milk extracted with boiling water did not show coagulation by rennet, whereas it was coagulated by rennet when extracted at room temperature.

It was known to become more digestible by pepsin when soy-bean milk was treated with heat or rennet previous to adding pepsin. In these respects soy-bean milk is analogous to cow's milk.

58. Chemical studies on the autolysis (rigor mortis and rigor off) of meats. Part I. On the changes of acid-soluble phosphorus compounds. Rinjiro SASAKI, Masao FUJIMAKI, Kenzo KOJŌ and Toshio TANAKA (Journ. Agr. Chem. Soc. Japan. **27**, 725, 1953)

(1) Some preliminary examinations were carried out on the methods for the analysis of acid-soluble phosphorus compounds of meats.

(2) The acid-soluble phosphorus compounds of whale lean meat (chilled) were analysed.

(3) Postmortem changes of acid-soluble phosphorus compounds of the muscle of rabbit as a warm blooded animal and carp as a cold blooded animal were tested during the storage of 96 hours at 0-4°C. Both muscles seemed to enter into full rigor, with the disappearance of ATP, in about 24 hours after the death. Differences of contents of the compounds between both muscles were discussed.

(4) Changes of acid-soluble phosphorus compounds of frigate mackerel were studied to know how the immediate treatments after the catch have effects on the autolysis. Remarkable differences of contents of the compounds and the onset of rigor were recognized between the muscles of instant death and death in agony.

59. Chemical studies on trimethylamine in meats. (Chemical studies on preservation and preparation of meats and meat products. Part 3). I. On the methods of colorimetric estimation of trimethylamine. Rinjiro SASAKI and Masao FUJIMAKI (Journ. Agr. Chem. Soc. Japan. **27**, 420, 1953)

II. On trimethylamine produced from heating of meats. Rinjiro SASAKI, Masao FUJIMAKI and Satoshi ODAGIRI (ibidem **27**, 427, 1953)

1. Methods of colorimetric estimation of trimethylamine were discussed to determine the freshness of meats and meat products. The modified DYER's picrate method was found to be satisfactory as simplified determination of amines, and the CROMWELL's aconitic method was available to determine trimethylamine in raw meat without distillation procedure.

2. During spoilage of meat and fish meat, changes of trimethylamine contents were determined by both colorimetric methods. In anaerobic condition, spoiled tunny meat produced more trimethylamine than the quantity attributable to its trimethylamine oxide content.

3. Colorimetric estimations of trimethylamine were carried out in fresh, cooked, and canned meats of tunny and bonito by both methods without distillation. In this case, colorimetric values increased in cooked and canned, compared to fresh meat. Similar increase was also found with aqueous extracts of meats.

4. The meats in which colorimetric values increase during heating seemed to have correlation with those which contain trimethylamine oxide. In the meats of tunny, bonito, shark, and squid, colorimetric values increased, while in those of carp and pork they did not.

5. The colorimetric value of the distillate of deproteinized solution of cooked tunny meat increased as strongly as that of its filtrate by the picrate method, but scarcely did it by the aconitic method.

6. Thus the colorimetric estimation of trimethylamine in heated meat should be made by the aconitic method with its distillate of deproteinized solution.

7. When such a meat as pork, which did not contain trimethylamine oxide, was

heated with addition of the oxide, its reduction to trimethylamine was recognized in a slight degree. Of course, this reducing power depended upon the degree of heating and was measured by the ferricyanide method, where reduction by SH groups are measured inclusively.

8. Trimethylamine was isolated from cooked meat of fresh tunny as its chloroaurate. Other amines than trimethylamine produced from cooked tunny meat were not yet identified, but slight degree seemed to be tertiary amines by the increase of colorimetric value in the aconitic method.

60. Studies on the nutritive value of grass protein. Part 4. The effect of the method of desiccation on the nitrogen distribution in the leaf of radish. Makoto KANDATSU and Tadahiko YASUI (Journ. Jap. Soc. Food and Nutrition **6**, 32, 1953)

Experiments were performed to elucidate the effect of drying method on the nitrogen distribution in the leaf of radish. The results obtained were as follows: (1) About 98% of crude protein and about 96% of true protein in the green leaf of radish are soluble, in which 0.3% NaOH soluble true protein content is 67%; water soluble one ranked the next. (2) Dried in the sun, decomposition of true protein was not found, but 0.3% NaOH soluble protein remarkably decreased. On the contrary water soluble protein remarkably increased, and water insoluble non-protein nitrogenous compounds changed to water soluble one. (3) Dried at 40-50°C without aeration, true protein determined directly, did not change and 0.3% NaOH soluble protein remarkably decreased, water soluble one decreased a little. But 0.3% alkaline 60% hot alcohol soluble and insoluble proteins remarkably increased. (4) In the true protein determined directly, keep about 20-30% of non-protein nitrogenous compounds, which were contained in each fraction, especially in 0.3% alkaline 60% hot alcohol fraction.

61. Studies on the nutritive value of grass proteins. Part 5. The effect of drying on the nitrogen distribution in the green leaf of soy bean. Makoto KANDATSU and Tadahiko YASUI (Journ. Agr. Chem. Soc. Japan. **28**, 494-499, 1954)

The effect of drying on the nitrogen distribution in the leaf of soy bean was studied. Results obtained were as follows:

(1) True protein content of the leaves dried under various conditions showed remarkable decrease. The cause of the decrease had been usually considered as the result of protein decomposition by drying. But our results indicate that apparent decrease of protein was caused by the change of solubility of non-protein nitrogenous compounds in the employed solvent, and no actual change in protein content occurred.

(2) 90% of total nitrogen and 76.3% of true protein of the fresh green leaf were soluble in water (39.3% and 22.4%), 0.3% alkaline 60% hot alcohol (33.5% and 32%), and 0.3% NaOH (9.7% and 18.6%). The quantities of 10% NaCl and 70% alcohol soluble fractions were very little, so the nutritive value of protein of the fresh green leaf of soy bean could be represented by the properties and amount of the former three proteins.

(3) Among the drying methods examined, rapid aeration method was the best in which the change of nitrogen distribution was extremely small. As to the decrease of water soluble nitrogen by the above aerated drying method, it was assumed that a part of it turned insoluble but any other change was not observed.

(4) By the drying in the sun or in the even at 40-50° with no aeration, 0.3% alkaline 60% hot alcohol soluble fraction remarkably decreased, and accordingly insoluble nitrogen increased. Less amount of protein, however, was soluble in 0.3% alkaline 60% hot alcohol, 0.3% NaOH, and water, and insoluble protein showed remarkable increase. Simultaneously with these changes, a part of non-protein nitrogen which was in 0.3% alkaline 60% hot alcohol soluble fraction, turned into water soluble.

62. The biochemistry of Bakanae fungus. Part. 27. The production of gibberellin by submerged culture (3). Hiroshi KITAMURA, Akira KAWARADA, Yasuo SETA, Nobutaka TAKAHASHI, Toshio OTSUKI and Yusuke SUMIKI (Journ. Agr. Chem. Soc. Japan. **27**, 545, 1953)

Two strains of *Gibberella fujikuroi*, i.e., G-4 and As6-7 were selected for the production of gibberellin in the submerged culture from twenty strains through the shaken culture method with or without the test pieces of metals. It was found that the amount of gibberellin produced was smaller in the presence of even the stainless steel 18-8 than in the absence.

Submerged cultures were carried out with these strains in a 150 L. tank made of stainless steel 18-8. As a result, the production of gibberellin was nearly estimated to be corresponding to $8\,\mu g$ of the pure gibberellin A per 1 cc of the culture medium by the bioassay method.

63. The biochemistry of Bakanae fungus. Part 31. The physico-chemical determination of gibberellin. Hiroshi KITAMURA and Yusuke SUMIKI (Journ. Agr. Soc. Japan. **28**, 449, 1954)

The bioassay using rice seed was the only method for the quntitative determination of gibberellins. But this method is not so good, because not only it takes about 10 days but also the result is unreliable on account of the individuality of each seed. Therefore, it is hoped that some physico-chemical methods should be found as soon as possible. For this reason, this experiment was undertaken and the following results were obtained.

(1) The authors found that the relation between the extinction coefficient and the concentration of gibberic acid was proportional satisfying LAMBERTBEER's law, and therefore gibberic acid could be determined quantitatively by the spectrophotometric measurement.

(2) The authors found that gibberellin A gave a reduction wave. In a 0.5×10^{-3} M solution of this substance, when $0.04\,N$ tetramethylammonium bromide was used as a supporting electrolyte, the half-wave potential was -1.56 volts (vs. S.C.E.). As the relation of the wave-heights of gibberellin A to its concentration was found to be proportional linearly, gibberellin A could be determined quantitatively by means of the polarographic method.

64. Studies on the microbial growth. Part 5. Th eeffects of sodium chloride on the bacterial growth. Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan. **28**, 299, 1954)

(1) The effects of sodium chloride on the growth of *Escherichia coli* of changing the sodium chloride concentration in three basal media (peptone water, meat-extract peptone broth and KOSER's synthetic medium) were studied. The result showed

that 0.1～0.3 M sodium chloride was stimulatory and higher concentration toxic in all media. The midly stimulating salt or midly toxic salt was not found. The maximum growth attained by the shaking cultures was greater than that by the stationary cultures at the same concentration of sodium chloride. But the relationship between the concentrations of sodium chloride and the effects on the bacterial growth was same under both conditions.

(2) From the growth curves of the subcultures in the fresh peptone water containing the same sublethal concentration of sodium chloride as the previous culture, it might be allowed that the mechanism of the adaptability to sodium chloride is first formed within the cells. But after the long incubation, an anti-salinity factor might be found in the medium, and at this period, the adaptability of the bacterial population might be responsible for this factor, not only for the adaptability of the individual cells. This factor was presumed to be the optimum oxidation-reduction character of the culture for the bacterial growth, which was considered to be somewhat lower than that of the fresh medium.

65. Studies on the microbial growth. Part 6. The tolerance of the bacteria to sodium chloride. Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan. **28**, 304. 1954)

(1) In the peptone water, the adaptability of *Escherichia coli* to salinity can be increased without any cell division. (2) In the phosphate buffer solution as the starvative environment, the adaptability cannot be increased by the addition of sodium chloride in any way. (3) The process of acclimatization of the bacterial population is readily reversible. (4) By the procedure of the starvation, the viability to saline media is not lost, but the lag of the bacterial growth is prolonged. (5) Effects of the bulk pH under the various salinity on the bacterial growth are measured. The results show that the lag and growth rate are maximum at pH 6.8 at any salt concentration, and the parallelism between the salt action and pH tolerance of bacteria is established. (6) The bacterial adaptability to sodium chloride may be not owing to the gene, but to the intracellular metabolic system which can be induced directly by the sublethal concentration of sodium chloride and affected by the bulk pH and oxydation-reduction potential.

66. Studies on the microbial growth. Part 7-8. The method of determining the viable count of the Hiochi bacteria putrefying Sake and their growth curves. Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan. **28**, 418, 1954)

(1) The viable counting of the seven strains of "Hiochi bacteria" which putrefy Sake could be made by the capillary tube method. As the sipmlest and best medium for this counting diluted Sake agar containing 1% peptone (pH 4.6) might be adopted and both growth curves in the liquid cultures and colony counts using this medium were identical to that using the semi-synthetic medium containing casein hydrolysate, amino acids, vitamins, pyrimidine and purine bases, salts, glucose, tomato juice, liver autolysate, and Sake. By the addition of Na-thioglycolate to this medium the development of the colonies was stimulated, but the colony counts were not increased.

(2) By this method of the viable counting, growth curves of five strains were measured. As results, it was established that their growth fitted to VERHURST's logistic curve by means of the finite difference diagram discussed in part 2. Two strains incubated for 6 months at 30° showed the composite growth curves.

67. Studies on the microbial growth. Part 9. The influences of amino acids added to glucose ammonium salt medium on the bacterial growth (No. 1). Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan 28, 460, 1954)

The stimulatory or inhibitory effects by changing amino acid concentration in KOSER's synthetic medium on the growth of *Escherichia coli* were studied, and the amount of sodium chloride which should be contained in the medium were adopted both of 0.1 M and 0.5 M as the stimulating and sublethal concentrations respectively. The results were shown in the L-C diagrams indicating the amino acid concentration —lag curve, and the effects of amino acids were classified into two groups including six subgroups.

(A) The group which does not change the type of action* with both of 0.1 M and 0.5 M NaCl:

Subgroup I (+(0.1M**), +(0.5M)) glycine, L-, DL-alanine, DL-valine, DL-serine, L-phenylalanine, L-, DL-tyrosine, L-histidine, L-proline, DL-tryptophan, L-lysine, L-isoleucine, L-glutamic acid, L-aspartic acid, L-arginine.

II (+0−(0.1M), +0−(0.5M)) L-cysteine, L-cystine, *p*-aminobenzoic acid.

III (+−(0.1M), +−(0.5M)) taurine, *α*-amino-*n*-butyric acid.

(B) The group which changes the type of action with 0.1 M and 0.5 M NaCl:

Subgroup IV (+(0.1M), +−(0.5M)) DL-threonine, hydroxy-L-proline.

V (+0−(0.1M), +−(0.5M)) sulfanilic acid.

VI (+−+(0.1M), +−(0.5M)) L-, DL-methionine.

From the transformation of types with the salt concentration, sodium chloride is considered not only to act in the permeability of the bacterial cells, but also to inhibit the metabolic systems within the cells.

68. Studies on the microbial growth. Part 10. The influences of amino acids added to glucose ammonium salt medium on the bacterial growth (No. 2). Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan 28, 465, 1954)

The inhibitory actions of DL-threonine and hydroxyl-L-proline with 0.5 M NaCl to *Escherichia coli* were studied. The results were as follows: (1) The higher concentrations of DL-threonine and hydroxy-L-proline with 0.5 M NaCl showed the inhibitory actions and their actions were bacteriostatic. The inhibitory action of 1.4×10^{-2}M DL-threonine to the logarithmic growth of *E. coli* was found at 1.5 hours after the addition of it with and without NH_4 salt in the medium. The inhibitory effects of DL-threonine and hydroxy-L-proline were respectively antagonized by valine and proline. (2) The effects of the other amino acids on the inhibitory action of DL-threonine could be well examined by the L-C diagram method (cf. Part 9), for example, aspartic acid and glutamic acid were simply stimulatory, valine antagonistic, isoleucine inhibitorily synergistic, leucine non-effective to threonine inhibition. (3) The scheme of the biosynthesis for threonine, isoleucine, valine, and leucine were shown in Table 1 and the effects of the addition of isoleucine or leucine on the action of threonine gave supports to this scheme.

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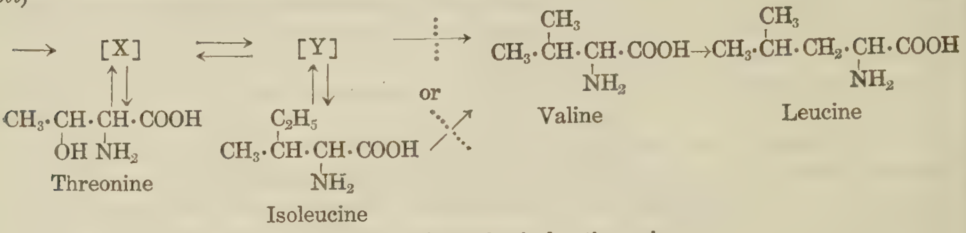
* The type of amino acid action was expressed by the sign of the first derived function of the lag-amino acid concn. curve, that is the type of the decreasing or increasing lag to the increase of amino acid concn. being indicated as the type + or −.

** Concentration of NaCl containing in the medium.

Table 1. Scheme of Biosynthesis for Threonine, Isoleucine, Valine, and Leucine (*E. coli*)



Broken lines show the blocking of biosynthesis by threonine.

69. Studies on Sake brewing water. Part 1. Chemical composition of Sake brewing water. Shigezo KANOH (Journ. Agr. Chem. Soc. Japan **27**, 881, 1953)

Fifty-four samples of Sake brewing water, which were gathered from brewers located in nearly all the districts of Japan, were compared with their chemical compositions. They can be divided into five groups as follows: the first group is characterized by the rich contents of phosphates; the second group shows generally higher quatities of all components except phosphate compared with the other groups; the compositions of water of the third group are very similar to those of the first except the very low contents of phosphates; the fourth group consists of those which are lower in the salts contents than those of the third except sodium, and last the fifth group involves the water which has the lowest content of salts. All of the first group belong without exception to the water called "Miyamizu" which is famous for being used for the brewing of "Sake of Nada". The third group includes samples from Fushimi and Hiroshima and are well known for the production of good Sake.

70. Studies on variation of penicillin producing molds. Part 15. Organic acid fermentation of *Pen. chrysogenum* Q 176 and Pigmentless Sultant *Pen. chrysogenum* Q 176 Arima et Ogasawara. Kei ARIMA and Nagahiro OGASAWARA (Journ. Agr. Chem. Soc. Japan **27**, 537, 1953)

The organic acid fermentation of *Pen. chrysogenum* Q 176 and of the Pigmentless sultant were studied, in surface and shaking culture on medium containing 10% glucose. Q 176 and the Pigmentless sultant produced 51.7% and 47.1% gluconic acid, 10.2% and 9.8% succinic acid, and 0.4% and 0.32% lactic acid respectively, based on the consumed sugar, utilization of sugar being 98% in both cases.

Other organic acids usually produced by molds were not found by these molds.

In organic acid productivity, Q 176 and Pigmentless sultant strain were considered to be almost the same, but actually Pigmentless sultant proved to be somewhat weaker in the productivity.

So this sultant may be called regressive mutant in these particular properties too, as similar to the case of other mutants.

71. Studies on the requirements of amino acids and vitamins of yeasts. Part 3. Masahiro TAKAHASHI (Journ. Agr. Chem. Soc. Japan **28**, 425, 1954)

So-called sake-yeast cannot grow in the solution of amino acids mixture as nitrogen source without vitamins, particularly pantothenic acid. On the contrary ammonium sulphate can be assimilable without vitamins.

But the sake-yeast cannot grow when ammonium sulphate is added to the solutions of amino acids mixture. The author now speculates that this phenomenon is caused by the inhibitions of several amino acids, histidine, arginine, methionine, glutamic acid, isoleucine, threonine, tyrosine, valine, serine and glycine.

Especially, histidine inhibits the growth completely.

72. Studies on the requirements of amino acids and vitamins of yeast. Part 1. Masahiro TAKAHASHI (Journ. Agr. Chem. Soc. Japan **28**, 395, 1954)

The author has isolated Mycotorula No. 1 from acid digest of soy bean. This strain could utilize the amino acids mixture as nitrogen source without vitamins and this amino acid was proved as histidine.

Optimum concentration of histidine was from 1 mg/cc to 4 mg/cc in 5% glucose medium.

On the contrary the Saccharomyces Saké required the vitamins in the medium of amino acid mixture as nitrogen source.

These results can be observed when the inoculum size was controlled under 5000 cells per 1 cc of culture medium.

Investigation of this problem will be published later.

73. Studies on the requirements of amino acid and vitamins of yeast. Part 2. Masahiro TAKAHASHI (Journ. Agr. Chem. Soc. Japan **28**, 398, 1954)

In this investigation, an attempt was made to study the growth of yeast, so-called brewery yeast, distillery yeasts and Saké yeasts, in solutions of amino acids mixture as nitrogen source. It was found that these groups of yeasts can not grow in a solution of amino acid mixture as nitrogen source without vitamins.

And these required vitamins were different in the above three groups of yeasts.

These results can be observed when the inoculum size was controlled under 5000 cells per 1 c.c. of culture medium.

These growth requirements were found to be relatively stable and could be used to identify the above specific groups of the yeasts.

74. Studies on variation of penicillin producing molds. Part 16. Successive subculture and genetical consideration of the variation of *Pen. chrysogenum* Q176. Wis. Kei ARIMA, Hideo NAKAMURA and Kazuo KOMAGATA (Journ. Agr. Chem. Soc. Japan 27, 565, 1953)

Variation in morphology and penicillin run down of *Pen. chrysogenum* Q176 and the pigmentless sultant strain during twelve generations of successive subcultures on eleven different media with special reference to the influence of C./N. ratios of media, nutrient rich and poor media on the above variation of these molds were studied.

Mutation rate and penicillin run down at each generation are shown.

In the case of the medium containing no orgaic nitrogen, majority of the spores of the culture turned to the flat type mutant, while in the case of medium rich in peptone, the heavy flat type mutant, which were described in the Part 5 of this report, predominated.

No remarkable morphological variation and penicillin run down were recognized in MOYER medium and modified MOYER medium even after twelve successive subcultures.

The authors then tried to propose some genetical explanations of the phenomenon

of the variations or occurrence of many mutants derived from *Pen. chrysogenum* Q176 and of the various experimental data of several aspects of variation of this mold which have been obtained in the previous sixteen reports.

In this report, a method of developing mutants from the various mutants already obtained by further irradiation of ultraviolet ray upon them and a method of repeating irradiation on the newly induced mutants were adopted.

By this method a scheme of developmental lines of mutants from Q176 was drawn.

It was presumed, from the analogy of the gene mutation of *Neurospora* by BEADLE et al., that mutations in spore formation, penicillus formation, coloration of spore and the yellow pigments synthesis etc. were all considered as one step of gene mutation.

Thus some new knowledge was added to the explanation of the variation of Penicillium which propagates by non-sexual way and reports concerning this point have been rare so far.

75. Fundamental studies on the aerobic fermentation. Part. 2. Determination of an empirical formula for the efficiency of oxygen supply of a fermentor. Part 3. Oxygen absorption rate in the aerating fermentor without agitation. Kōichi YAMADA, Jyōji TAKAHASHI, Hiroshi OKADA and Akira YAMAMOTO (Journ. Agr. Chem. Soc. Japan **27**, 704, 1953; **28**, 156, 1954)

The rate of oxygen supply from gas bubble to medium in an aerobic culture is mainly influenced by several factors—the type of the agitator and the sparger, which are characteristic of a fermentor, and the revolution number of the agitator and the air flow rate, which are independent of the design of a fermentor.

Figure 1.
Effect of the air flow rate on K_a at constant revolution number (single hole sparger with a disk type agitator was used).

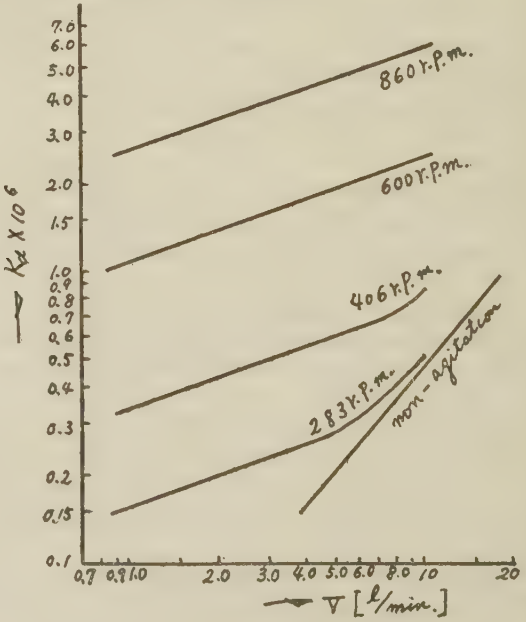


Figure 1.

By means of sulfite method, the effects of those factors on the oxygen absorption coefficient of medium, K_d, was quantitatively determined, and the following results were obtained.

(1) From the results as shown in the Fig. 1, under limited conditions of air flow rate and revolution number, the following empirical formula was obtained, between K_d (gr. mol of O_2/min. atm. cc. of medium) and air flow rate V (L/min.) and revolution number N (r.p.m.)

$$K_d = k(V/v)^{\alpha} N^{\beta}$$

where, k, α, β are constants which are characteristic of a fermentor and v=volume of liquid in the fermentor (L)

In case of the 5L capacity laboratory fermentor of the university, the values of those constants were: $\alpha = 0.30$, $\beta = 2.56$ and $k = 1.31 \times 10^{-15}$ for the combination of a single hole sparger with a disk type agitator, and $\alpha = 0.37$, $\beta = 2.45$ and $k = 6.35 \times 10^{-13}$ for the combination of a ring type sparger with two paddle type agitators.

It is clear that the fermentor which has the larger values of α, β and k, is desirable, in order to supply the larger amount of oxygen to medium, by the constant air flow rate and the revolution number.

(2) As shown in the Fig. 1 the slope of the curve, i. e. the value of α, which represents the degree of the effect of the air flow rate on K_d, gradually increases in the region of the small revolution number and the high air flow rate. And it reaches the value of 1.19, when the revolution number N reaches zero.

(3) In case that was not accompanied with agitation, the following empirical formula between K_d and V was generally obtained, for every types of spargers [single hole, ring (10 holes), radial (36 holes) and eddy (84 holes)] used.

$$K_d = k(V/v)^{1.19}$$

where, v the volume of liquid in the fermentor
and k: a constant

The value of k is nearly equal to 2.4×10^{-7} for each type sparger used.

This fact indicates that the changes of the sparger type and hole numbers have little effect on the rate of oxygen supply to medium in the fermentor which is not accompanied with agitation. Therefore, from the standpoint of cleaning and construction cost of a fermentor, a sparger simply constructed is desirable.

(4) The effect of liquid depth on K_d can not be ignored. As described above, in the laboratory fermentor, K_d was given by the equation, $K_d = 2.4 \times 10^{-7}(V/v)^{1.19}$, when the liquid volume v was 5L. But, when v was 2L in the same fermentor, K_d increased proportionately and was given by the equation $K_d = 2.98 \times 10^{-7}(V/v)^{1.19}$.

76. Studies on the continuous fermentation. Part 2. Fundamental studies of continuous alcoholic fermentation of molasses. Toshinobu ASAI, Kiyomoto UEDA and Tetsuya KOJIMA (Journ. Agr. Soc. Japan **27**, 586, 1953)

The authors investigated the continuous molasses fermentation based on the growth and fermentation curves by two fermentors in series. Various conditions affected to the growth and fermentation, and continuous fermentation cycle times in primary fermentor were examined. To operate the continuous fermentation, according to ADAMS' theory, the following theoretical relation between the growth and fermentation curves must be satisfied when continuous feed start.

$$\frac{\text{Total Yeast Cells}}{\text{Yeasts Cells Prodused per hr.}} = \frac{\text{Total Sugar Fermented}}{\text{Sugar Fermented per hr.}}$$

When the amount of inoculated yeasts are not negligible to the produced yeasts, the continuous operation can not be attained by the cycle time calculated from the analysis of the growth curve. In such a case, the steady state of fermentation can be maintained readily, if the cycle time calculated from the curve of produced yeasts is used after reducing the yeasts level equal to the inoculum size from the fermenting mash by a rapid withdrawal of medium plus cells followed by replacement with fresh medium.

77. Studies on the continuous fermentation. Part 3. Continuous alcoholic fermentation of molasses by laboratory scale equipment. Kiyomoto UEDA, Tetsuya KOJIMA, Takanosuke MIYASAKA and Toshinobu ASAI (Journ. Agr. Chem. Soc. Japan **28**, 62, 1954)

In this paper, experiments were conducted to operate the continuous fermentation of molasses by laboratory equipment. Molasses was successfully and continuously fermented with the cycle time of 24 hours and controlled pH for extended period without any apparent yeast degradation. The fermentors consisted of two ten-litter glass jar fermentor in series.

The mash was agitated mechanically and removed continuously by overflow system. When the population level of about 120×10^6 cells per ml., was maintained in the secondary fermentor, the fermentation cycle (24 hours) was nearly equal to that batch fermentation which was inoculated with a small quantity of yeast and agitated mechanically. At a population level of about 190×10^6 cells per ml., the fermentation cycle was reduced to 16 hours.

III. Agricultural Engineering

Abstract Nos. 78—88

78. Exploration of leakage system of Shironotani-ike and its counter measure. Masuji AKIBA (Reports of research published by Chugoku and Shikoku Branch of Agr. Eng. Soc. **No. 7**, March 1954)

In order to consider a logical, leakage-prevention measure against a storage reservoir, it is necessary to know how leakage of water takes place. Up to now various kinds of methods have been devised for the purpose, but for the leakage investigation of Shironotani-ike, Ehime Prefecture, a simple prospecting method of pipe-driving was adopted from the view point that this method might be practised without any advanced engineering or much experience.

The Shironotani-ike reservoir was constructed in order to supplement irrigation water to Shironotani valley in the south of Himi-machi, Saijo-City (relative area 565 ha). This is of an earth dam type with a central core, the height and length of the dam being 27.35 m and 133 m respectively. Water is leaking at 6 places, one of

which is a leakage from a narrow area, and the other five are leaking from rather wide areas as large as 20-200 m^2.

In order to get information about which paths of the dam body the leaking waters pass through, degree of compactive and permeability were obtained concerning every post of the dam body, from which the leaking condition of it was estimated.

Though cement or clay grouting is considered as the preventing measure against the leakage of the storage water, the latter has been adapted as a result of the preliminary tests carried out twice.

The following items are also necessary as other measures to be practised.

(1) Leakage prevention method of storage water.

Clay-bentonite grouting will be practised in two rows of a zigzag way at spacings of 2 m in the corewall, and grouting in two rows its to be practised at 6 places on the right side and 10 places on the left side of the dam, at 32 places in total, the operation of which should be carried out with at most precauation at unfavorable places.

(2) Surface run-off and percolating water near down stream surface of dam.

The percolating water near the surface due to rainfall isn't very dangerous. The run-off from the natural ground at the right side should be discharged as quick as possible by constructing a drainage canal for the purpose of the slope protection. And moreover, 2 or 3 conduits should be installed near the surface, centering around the existing leaking place at the lower part from the berm.

(3) Springs from natural ground.

As it is acknowledged that more accurate investigation is necessary about springs, the handling of them is to be decided by the result of grouting to the natural ground.

79. On research concerning soil dressing by hydraulic process in a district along Kurobe River. Masuji AKIBA, Yoshiharu IWASAKI and others. (Reports of research published by Chūgoku and Shikoku Branch of Agr. Eng. Soc. 7, March 1953)

The project area occupies such paddy areas as wide as 6,000 ha where the surface soil of sandy nature is very thin in depth and shortage of iron components is keenly felt. In this area are included Sakurai-machi, three other towns and eleven villages extending over along both banks of the Kurobe river. The irrigation water which is taken in from the river is sufficient enough, but as the river is fed by cold water due to the melting snow of the Northern Alps, the water temperature never exceeds 15°C even in the hottest season. By this reason the river is said to be as one of the coldest rivers of Japan.

The lower soil of the farm land all over the district is of sandy gravel layer with bouders, overapped by sandy soil only 8-13 cm thick, and naturally percolation loss of irrigation water reaches to such a large amount as 100-180 mm.

Production of unhulled rice per *tan* is about 1.7 *koku* on the average.

In order to improve this unfavorable condition, the silt excavated by means of a jet pump was conveyed, so that 150-350 m^3 of soil per ha might be deposited evenly at the extreme part of this project area, by which water holding capacity of soil would be increased and irrigation water in the paddies would also be warmed up. Further the loss of fertilizer due to the large percolation and "akiochi" (when some sign of poor rice crop makes appearance abruptly in the fall, though the rice plants

have been in a normal condition, it is called "Akiochi") would be prevented.

Experiments were mainly practised concerning the following 5 items, which are summarized below:

(1) Soil

Soil was conveyed by means of water jet under the water pressures of 52-58 lb/cm^2 and 65-68 lb/cm^2 in cases of 1 and 0.7 in. in diam. respectively. The proper spacing of the water jet was about 5-8 m.

(2) Canals

Two cases were observed concerning water flowing in canals, namely, fine silty soil in suspension in the water and coarse particles rolling or sliding upon the bottom of a canal. In case of soil dressing by water jet method, the above condition should be taken into consideration first, and then such items as the slope of water surface, size and capacity of a canal, etc. be laid out.

For instance, it is necessary that the KUTTER's coefficient of roughness "n" should be corrected in the case when fine silt in suspension is flowing in a wooden aqueduct with a gradient over 1/300.

It is necessary the value of "n" should be taken larger by 0.001-0.003 or 0.002 on the average in case of silt of 2.6-4.0% as compared with 1% silt.

(3) Soil to be applied and soil layer of paddy fields.

The soil to be applied is reddish, of tertiary formation, which is generally suitable for the purpose of soil dressing. But the quality of soil will become worse with deeper excavation as the gravel will increase in proportion to the depth of excavation. The sand contained in the soil will flow down with silty mud and disintegrate in the course of two or three years in the mingled state with the farm soil.

On the other hand the soil profile of paddy shows that there exist several layers in the depth of 100 cm from the ground surface, and coaser particles increase in deeper layers. The reaction due to leaching of iron components are seen at the boundary between the second and the third layer, or all over the third layer.

(4) Silt deposit in paddy fields.

Soil amount per one parcel of paddy V is:

$$V = Q \times P \times K_1$$

where Q: Total quantity of water

P: Amount of soil deposited in 30 min. in a cylinder (cc)

K_1: 0.12, constant obtained by experiment

P and K_1 in the formula must be clarified by the results of many experiments in future.

(5) Productions compared in paddy areas where soil dressing was practised or not.

Though percolating amount of water decreased by the practice of soil dressing, and water temperature rose by about 2°C, much wasn't expected about the effect of soil dressing, because the weather was abnormal this year (1953), and crop control wasn't good after the practice of the enterprise.

Owing to the negligence of some farming management the production increase of rice was only 3-4%.

Notwithstanding that percolating amount decreased by the practice of this job, water temperature didn't rise and efficient effect owing to soil dressing wasn't obtained, for the same amount of irrigation water was applied as usual in this case.

80. Research on expansion of uses of power tiller (First Report—On running capacity of tiller). Fusanobu SHOJI (Rept. Sci. Res. of Education Ministry **48-60,** 1954, printed by institute of Agr. Machin.)

The author practised measurement on such items as running velocity, traction power, swing of tiller itself, etc., and conducted running tests on traction power with 7 kinds of the tillers on farms of different kinds of soil and roads of various nature, in order to investigate the practical application of the running apparatus of a power tiller.

Generally speaking, traction power of a tiller on road surfaces is about 100 kg, the largest being shown on grass-grown roads; pneumatic tires are better than iron tires on gravel or concrete roads.

Velocity-decreasing ratio while in traction is large on concrete and earth roads; pneumatic tires on gravel or concrete roads.

In this case the traction horse-power is about 0.3-1.0 HP, which is nearly equal to that of a garden tractor produced in our country.

Traction power is only about 60-70 kg in uncultivated upland, and moreover, velocity-decreasing ratio is also very large; but the traction power of double or more than that in case of upland is generally obtained in case of dried paddy, and the velocity-decreasing ratio is also less. The above reasons are caused by the facts that earth in upland fields is softer of the two and wheels sink into the earth very much, which will cause big running resistance.

It was shown that traction power and velocity-decreasing ratio while tilling operation is being practised are almost similar to those in uncultivated upland. It is considered that even though motive power is more or less consumed by tilling movement of tines in case of Rotary- or Crank-type, the machinery itself is, after all, driven forward.

In order to investigate the swing of a tiller, miniature electric bulbs were fixed on the principal parts of a tiller, and pictures were taken while in motion at night, by the the moving loci were traced.

As a result of the above investigation, it was found that there are two kinds of wavy lines: one influenced by the ground surface, and the other originated by the vibration of the engine of the tiller. The wavy lines will become more smooth on flat farm surfaces than on agricultural roads, and the curves in case of tilling are, however, flatter than that on farm surfaces; and as regard to wheel-type, the similar relation is rather acknowledged in case of high velocity than in case of low velocity.

81. An experiment on the crushing of clay clods by tines. Fusanobu SHOJI (Journ. Agr. Machin. Soc. Japan **15**, 141-144, 1954)

As a partial study on the fundamental relation between crushing operation of soil ad its optimum period, the author applied various types of tines by static load method to cylinders made of clay which have different moisture contents and are of 60 mm in diameter and height, and measured the resistance against crushing, properties of crushing, penetration, etc.

From the curves of the relation between moisture ratio and resistance against crushing it can be seen that there are three spheres. Though I sphere, which had a moisture ratio of more than 45%, was easy in penetration, it was not crushed, and its traces were only left. III sphere, which had moisture ratio of less than 10%, increased in resistance suddenly owing to consolidation of clay clods, and soil crushing became difficult. Such being the case, clay clods in the II sphere which had an inter-

mediate moisture ratio are desirable from the view point of crushing nature. And piercing type and sharp cutting type are preferable for tines. Around 30% moisture ratio in case of the former type anr 33-42% of the same in case of the latter type are considered to be the optimum period for crushing soil. But the limit of plasticity of this clay clod is about 32%.

82. On the effect of "Krilium" for brine super saturated with $CaSO_4$. Jiro SUGI (Bull. Soc. Salt Sci. Japan **7**, No. 31, 1954)

Out of Kriliums, soil conditions manufactured by Monsanto Chemical Co., U.S. . ., Formulation No. 6, also known as CRD-186, is a specially high molecular electrolyte, and said to be composed of calcium salt which is polymers of maleic acid and vinyl acetate. This conditioner has a remarkable effect upon converting soil into granular structure, which has caused public discussion in the soil improvement circle recently.

However, the author perceived that Krilium has a similar character to sodium alginate, and as a result of an experiment, he discovered that it has an effect for the brine super-saturated with $CaSO_4$.

Results of experiment.

(1) Educt of $CaSO_4$ at 50°C.

Table 1.

No.	Addition (P.P.M.)		Nucleus	Hours Spent (h)				
	Krilium	Algon		1	2	3	4	5
A-1	0		none	++	++	+++	++++	++++
2	15		,,	−	−	+	+	+
3	25		,,	−	−	−	−	−
4	50		,,	−	−	−	−	−
5		50	,,	−	+	+	++	+++
6		100	,,	−	−	+	++	+++
7		200	,,	−	−	−	−	+
8	15	50	,,	−	−	−	−	−

Sample : Specific gravity: 1.183 (33.5°C),
Ca/Cl = 0.00855,
+: educted amount.

(2) Educt of $CaSO_3$ at 70°C

Table 2.

No.	Addition (P.P.M.)		Nucleus	Hours Spent (h)				
	Krilium	Calgon		1	2	3	4	5
B-1	0	0	none	+	++	++	+++	+++
2	15		,,	−	−	−	−	−
3	25		,,	−	−	−	−	−
4	50		,,	−	−	−	−	−
5	15	50	,,	−	−	−	−	−

Note: Specific gravity: 1.171 (37°C),
Ca/Cl = 0.00883.

Table 3.

No.	Addition (P.P.M.)		Vibration	Nucleus	Ca/C		Ratio of Extract %
	Krilium	Calgon			Original Sample	5hh afterward	
C-1	0		−	−	0.00601	0.00289	51.9
2	25		−	−	,,	0.00580	3.5
3	25		−	+	,,	0.00523	13.0
4	0		−	−	0.00841	0.00747	11.3
5	25		−	−	,,	0.00842	0
6	25		−	+	,,	0.00842	0
7	0		−	−	,,	0.00617	26.7
8	25		+	−	,,	0.00842	0
9	25		+	+	,,	0.00723	14.1

Sample: Specific gravity C-1～3 1.192 (29°C),
C-4～9 1.170 (30°C),
Ratio of extract shows the amount lost by the treatment against the amount of the original sample 100.

In other words, the effect on the maintenance of super-saturation will be large, if Krilium is added to brine which is super-saturated with $CaSO_4$. Especially this phenomenon is remarkable in case of rather low temperature (50°～70°).

Moreover, its effect is more marked as compared with calgon the effect of which has been known up to now, and less amount will answer the purpose.

83. Electrolysis of sea-water by using ion exchange membranes. Jiro SUGI (Bull. Soc. Salt Sci. Japan **8**, No. 33, 1954)

The author conducted some experiments on the direct electrolysis of sea-water using ion exchange membranes in order to obtain calcined soda and chlorine, the methods of which are as follows:

(1) 2-compartment method,
(2) Quick-silver method,
(3) Quick-silver method with saturated salt solution,
(4) 3-compartment method by using anion and cation exchange membrane.

The following results were obtained:

NaOH was obtained by 63 and 90 per cent current efficiencies in cases of 2-compartment method and quick-silver method respectively; and NaCl diffused through membranes.

The author is now practising an experiment concerning a manufacturing process of brine by 3-compartment method.

84. Research on stump pulling (Third report). Stump pulling test of Japanese larch. Fujio YAMAZAKI, Toshio YAWATA and others (Journ. Agr. Eng. Soc. Japan **21**, 79-94, 1954)

The authors carried out a stump pulling test on Japanese larch (*Larix Kaempferi*) at Ohinata settlement at the foot of Mt. Asama, in Nagano Prefecture. The results obtained were as follows.

(1) Japanese larch has larger tractive resistance in case of stump pulling as compared with that shown by *hinoki* (*Chamaecyparis obtusa*) or Japanese red pine (*Pinus densiflora*). And moreover, its roots do not decay easily, so the resistance against stump pulling isn't decreased, even after several years. Thus Japanese larch may be said as one of the most difficult trees for stump pulling operation.

(2) The relation between the tractive resistance P (ton) of a hand-operated stump puller and the diameter D (cm) of a stump of a Japanese larch was as follows:

$P = 0.018\,D^{2.67}$ in case of one year after lumbering,
$P = 0.002\,D^{2.44}$,, 5 ,, ,, ,
$P = 0.001\,D^{2.56}$,, 10 ,, ,, .

(3) Direct draft method by a work stock (A stump is wound with a rope, so that a cattle or a horse may pull the rope) is simple and high in efficiency, but application of this method is limited only in case where the diameter of a stump is smaller than about 10 cm. A stump pulling is completed within 5 min. per stump on the average in case where a stump of Japanese larch which was cut down 5-7 years ago is smaller than 10 cm in diameter.

(4) Revolving method by a work stock (A log 3-4 m long is fastened to a large lateral-root of the stump with a chain, and the stump is revolved by the draft force of a work stock, one end of the log being tied to the animal) doesn't require special materials, and only a work stock and two labourers can dispose of a stump 15-20 cm in diam. in 10-15 min. on the average. This method is specially effective for the stump which has a large tap-root.

(5) A stump of a Japanese larch 20-25 cm in diam. is disposed of in 20-30 min. per stump by means of a hand-operated stump puller of chainblock-type (tractive power: 5 ton) by a team of three persons.

85. Research on stump pulling (Fourth report). Preliminary test on stump removal by burning method. Fujio YAMAZAKI, Toshio YAWATA and others. (Journ. Agr. Eng. Soc. Japan **21**, 93-101, 1953)

There are many methods of stump pulling, but most of them are practised by application of force. The defects common to them are enumerated as follows: (a) Pits are left at the places where stumps are pulled out; (b) Subsoil is brought up to the ground surface; (c) Much labour is required to dispose of the stump pulled out.

The burning method is this: A hole is bored into a stump, in which fire is set and the stump is burned to such a degree lest it should give any obstacle in case of farming operation. Such being the case this method doesn't have any one of the defects mentioned above. However, it is considered questionable whether such a method will be possible in such a humid country as Japan. The authors started their experiment about this method.

Logs of 30 cm long were prepared from the following kinds of trees and tested in place of stumps in the field: Japanese red pine (*Pinus densiflora*), Japanese oak (*Quercus crispula*), Chestnut, Cherry, Japanese cedar (*Cryptomeria japonica*), Beech (*Fagus crenata*), *Magnolia obovata*.

(1) Test about drilling holes.

Drilling was made as large as 24 mm in diam. vertically and horizontally to the section of a sample by means of an ½ HP electric drill, and the velocity was measured, by which the authors found that the degree of difficult for drilling increased

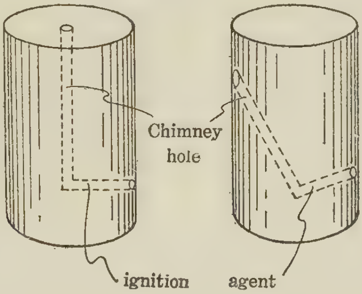
in the order of Japanese red pine, Japanese cedar, *Magnolia obovata,* Chestnut, Cherry, Beech, Japanese oak.

For the trees which are difficult in drilling, a drill of smaller diameter was employed at first, and then the drilling resumed again by a drill of the required size. Thus the authors found the operation was of less resistance and easier job.

(2) Tests about setting fire.

For the purpose of setting fire to the sample, pine resin, paraffin, gasoline, solidified alcohol, etc. were employed for the test, in which paraffin and pine resin were better as ignition agents, but gasoline and solidified alcohol were not suitable for the purpose. Degree of ignition was different by the kind of trees. Japanese oak was most difficult to be ignited, and Japanese red pine was the easiest. Chestnut, Cherry and *Magnolia* lie between the above two.

Ignition is influenced by the direction of drilling, and the type shown in the figure is good for absorbing air, and also convenient for pouring the ignition agent into the holes.



(3) Tests about combustion.

Relation between combustion and such items as wind velocity, kind of trees, direction of drilling was tested.

86. Research on stump pulling (Fifth report). Enquête concerning stump pulling in reclaimed lands all over the country. Fujio YAMAZAKI, Toshio YAWATA and others. (Journ. Agr. Eng. Soc. Japan **21**, 369-379, 1954)

The authors sent data sheets to settlers of reclaimed lands of as many as 376, requesting their answers, by which the characteristics of stump pulling have been classified in their respective regions from Hokkaido to Kyushu.

87. Research on stump pulling (Sixth report). Experiment of stump pulling by explosives. Fujio YAMAZAKI, Toshio YAWATA and others. (Journ. Agr. Eng. Soc. Japan **22**, 1-14, 1954)

It is very difficult to pull out big stumps by any other method than by blasting stumps by means of explosives.

The method which has been practised up to now is this: Explosive is charged in the ground under a stump and fired, by which the stump will be blasted into the

air. As the energy of explosive is absorbed in the soil by this method, large amount of explosive will be required, and it is impossible to apply this method for settlers from the economical view point, who have but scanty funds.

On the contrary, in case where holes are bored in stumps or roots themselves, in which explosives are charged, the energy of the explosives is used directly or effectively for destructing stump or cutting roots.

So the authors devised a method to employ less amount of explosives, by which an experiment was practised.

Holes were bored by means of ¾ HP electric drill operated by a portable engine generator, and dynamite and carlit were employed.

In case of such a stump as Japanese red pine (*Pinus densiflora*) which has a big tap-root, drill-holes can be bored in the tap-root, filled with explosive and blasted. Then the whole body of a stump will be raised, the tap-root being cut off, and the stump can be removed quite easily by cutting the lateral-roots by man power.

In case of such a stump as Japanese oak (*Quercus crispula*), which has many lateral roots, holes are made in the stump near the ground surface, in which explosive is filled, and exploded. Thus the stump is split into several pieces. Therefore, they will be disposed of easily by man power.

Suitable amounts of dynamite for explosion were about 45 gr for a stump 30 cm in diam. and about 90 gr for a stump 50 cm in diam. in case of Japanese red pines which were cut several years ago, and 60-90 gr for a stump 30 cm in diam. in case of Japanese oak. The cost per stump is only about ½ — ¾ as compared with the blasting method heretofore in use.

88. Zur Kinematik der Lenkgetriebe, insbesondere Selbstfahrender und gezogener Landmaschinen. Yoshichiro YASUDA (Concluded dissertation in German at the Munich Technical College in Jan. 1954. Introduced by Z. VDI **96**, 21, 732, 1954)

For the theoretical method of steering vehicles with the radius r of curvature in Fig. 1, the elongation of the axis of the steering wheels must intersect each other at the point M on the elongation of rear axis JH, which is not to be steered.

To put this principle into practice, the angles of the steering wheels are checked

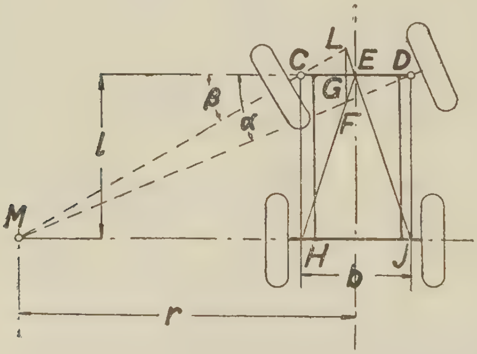


Fig. 1

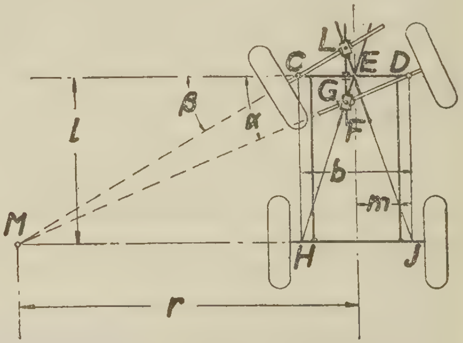


Fig. 2

as follows: Both king pins C and D are connected, and the middle point E will be connected with the foot H of the perpendicular to the axis HJ, through the pt. C. When the intersecting pt. F of MD and CE is connected with C, it is already found that

$$\angle FCD = \angle \beta$$

where $\angle \beta$ is the steering angle of wheel with king pin C.

So the test of the steering mechanism was made, whether the angle DCF', which was equally made the steering angle of inner wheel, intersects at the point F' with DM on the line EH or not.

The mechanism in practice till now is almost always approximate method.

The author has connected the point E with the other foot J of the perpendicular to the axis HJ through the pt. D, and let the elongation of JE intersect at the pt. L with the perpendicular through the pt. F to CD, and found that pts. L, C and M are on one straight line.

And

$$LG = GF = \frac{b \cdot l}{2r} = \frac{m \cdot l}{r}$$

$$GE = \frac{b^2}{4r} = \frac{m^2}{r}$$

$$LE = FE = \frac{b}{4r}\sqrt{b^2+4l^2} = \frac{m}{r}\sqrt{m^2+l^2}$$

where: $b = CD,\ m = \frac{b}{2},\ l = CH = DJ$

Therefore the author made a theoretical mechanism for the steering wheels as Fig. 2. The straight lines HE and JE act as the guide lines, on each line moves a slide member with pin F for HE and L for JE. On the pin F respectively L rotates two slide members, one of which slides along the DF respectively CL, the other slides along FG respectively LG. When the carrier LG moves links or lefts along CD from the pt. E, the directions of CL and DF determine the directions of the axis of both steering wheels entirely exact.

From the above mentioned principle the author developed the theoretical relations for each condition that can be considered. For example, whole wheel steering, steering for unsymmetry wheel distribution to the chassis center line, two wheel steering for the tricycle, steering for trailers from the tractor, etc.

As the mechanism is so great, the author made it proportionally smaller and connected to the king pin with the parallelogram mechanism. Further, when the scale in the small making is properly chosen, the distance F_1E_1 and F_2E_2....and L_1E_1, L_2E_2....for the whole conditions will be entirely same. So the author has turned these mechanisms as these distances come into one piece.

These small making with suitable scale and turning have a great deal for praixs.

Further the author has taken away the slide mechanism and introduced the KARDAN gear system and also developed the applied KARDAN system. So the slide mechanism is substituted into mere gear chains.

The author has the avalaible design for these principles with the model testing.

The steering mechanism with 3 dimentions is also theoretically and practically developed partially.

IV. Fisheries

Abstract Nos. 89 — 119

89. Under-water animal sounds around Japan. Yoshio HIYAMA (Rec. Oceanogr. Works in Japan 1, 105-112, 1953)

It was proved by the aids of underwater microphone and aquatic-apparatus that various kinds of under-water animals, fishes, shrimps and others make noise or sound at various occasions, both in aquarium and in open sea. In this work the author tried to make an ecological classification of these under-water animal sounds of various species, he could hear or record, as follows. (1) Feeding sounds. The sound produced by rubbing foods by oral apparatus, usually a sort of knocking sound, was found about in so numerous kinds of animals. (2) Swimming sounds. A periodical and continuous sound is produced when the cuttle fish swims. (3) Warning sounds. Gurnards, Spiny robster and others make distinct and loud sounds when the predator approaches. (4) Mating sounds. Croakers and others make continuous sounds in the spawning season to call another sex. (5) Breathing sounds. Dolphins and others make periodical sound when breathing the air. (6) Struggling sounds. Mostly produced when the fish was hauled by net, or handled by human being.

This classification can also denote the characteristic of sound as well as the occurrence of the sounds in some degree.

90. Difference of frequency of transfer among several types of fishes in underwater fence net model experiment. Yoshio HIYAMA, Masakazu YAO and Keikichi KONDO (Journ. Jap. Ichthyology 3, 179-187, 1954)

For the model fishing net experiment, to see the effect of fishing, the species of miniature fish employed should be not only of strong living nature and small enough to be proportional to the size of the net but also the one of having the same swimming habit as the commercial fish varieties to be caught by this fishing net. Generally, fishes can be classified ecologically into three categories, *i. e.* the surface dweller, the middle layer dweller, and the bottom dweller. In this work the authors tried to denote this ecological characteristic seeing the frequency of transfer, which has been studied in previous works of author, of each kind of fish to the underwater septum of various heights in experiment tank, just like underwater leading net of set net. The results of the series of experiments show distinctly that the common rice paddy Minnow, *Aplocheilus* (= *Oryzias*) *latipes* is the surface dweller, the Bitteling, *Acheilognathus lanceolata* is the middle layer dweller, and the Loach, *Misgurunus anguilicaudatus* is the bottom dweller as illustrated in Fig. 1. As this method can show the characteristics so sharply, even between the fishes supposed to be in the same category, *Acheilognathus lanceolata* and *Pseudorasbora parva*, the difference of the tendency was recoginzed.

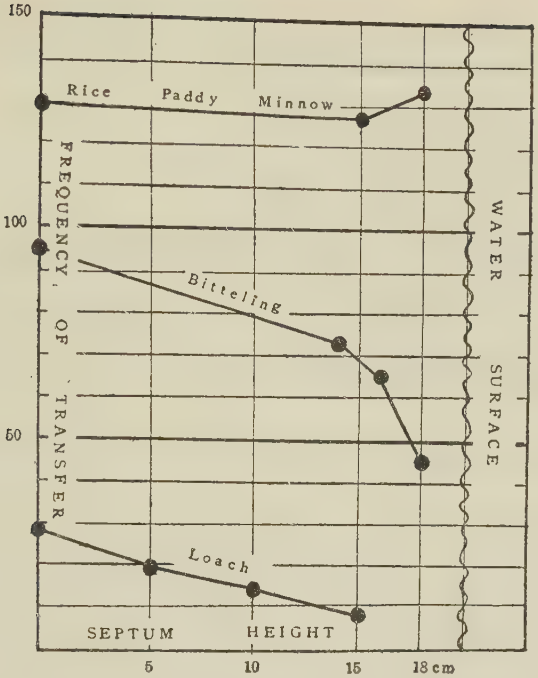


Figure 1. Frequency of transfer of three fish species in presence of under water septum of various heights.

91. The influence of various types of tags and Pb-injection upon the mortality rate of fish. Yoshio HIYAMA and Ryushi ICHIKAWA (Bull. Jap. Soc. Sci. Fish. **19**, 376-381, 1953)

The lead-injection method to measure the growth of hard tissues of fishes, which had been introduced in other papers by the authors, was applied to the cultivation and tagging experiments in order to know the influence of this method to the mortality rate of fish. And at the same time several kinds of tags were used in this experiment to compare the survival rate of each by the rate of recovery.

(1) In an aquarium cultivation experiment, the Pb-injection has along no influence on the mortality rate of the Common Goby, *Acanthogobius flavimanus*. On the other hand, the influence of tag bearing is quite significant and also so many tags dropped off from the operculum during this period.

(2) By comparing the rate of recovery in tagging experiments of the Common Goby in two years, the influence of pb-acetate injection was hard to recognize. The rate of recovery of the injected fishes was 5.3% and that of the non-injected ones was 5.1%.

(3) During the tagging experiments, usually the recovery of the tagged fish decreases week by week, the fewer in the later day. The rate of decrease of the recovery (Mx) of fish having a certain kind (x) of tag is caused by the natural mortality rate (M), the rate of fishing (f), increased mortality by the influence of

certain sort of tag (mx), increased mortality by Pb-injection (m') and rate of dropping of tag (m), if the rate of fishing during the period is constant.

So, the following formula can be considered,

$$1-Mx=(1-M)(1-f)(1-mx)(1-m')(1-m)$$

Tags used in this experiment were as follows.

a ...... Silver gilt copper needle with celluloid oval disc.

b ...... Nylon string with celluloid oval disc.

c ...... Silver needle with celluloid oval disc.

d ...... Silver needle and nylon string with celluloid oval disc.

The results obtained are:— $ma=0.32$, mb (1951) $=0.27$, mb (1952) $=0.07$, $mc=0.16$, $md=0.16$, m' (1951) $=0.08$, m' (1952) $=-0.27$.

Here, mx can be considered as the increase of mortality rate by having tag of a certain kind (x), so by comparing these we can improve the method of tagging year by year, if the methods more than two were applied in the same year.

92. Scale growth rate of the Common Goby assured by the lead-acetate injection method. Ryushi ICHIKAWA and Yoshio HIYAMA (Journ. Jap. Ichthyol. **3**, 49-52, 1954)

In the falls of 1951 and 1952, tagging experiments of the common goby were done in Tokyo Bay. On a certain number of these fishes, the lead-acetate injection method which was already introduced by the authors, was applied to mark the time on the growing scales. Namely, 0.1 cc of 0.1% lead acetate solution per 10 grms. of body weight, was injected into the dorsal muscle of tagged fishes. And the scales of recaptured fishes were treated as follows, to make clear the lead line marked on them which showed the margin of scale at the time of liberation. (1) Scales were immerged in 1% solution of HCl, continuously saturated by H_2S gas from the generator for about two hours. (2) After washing with water, it was immerged in 0.05% solution of $AuCl_3$ for about two hours. (3) Then, washed by 0.5% solution of sodium thiosulphate for about 5 minutes. By this treatment the lead-line on the scale became visible as a blue line, outside of which was the newly-grown portion of a scale atfer liberation.

In this case, as the injection was done at the beginning of October (4th and 10th), the blue lead-line appeared in the winter zone having wider intervals of circuli. The number of circuli which existed in the portion outer from lead-line, i.e. the portion grown since the injection, was counted. And by dividing it by the number of days passed since the injection to the recapture, the number of circuli formed in a day could be enumerated.

On the other hand, the number of circuli which existed between the lead line and the end of summer zone was counted. So, by the growth rate got by the method mentioned above, it was able to assume how many days had passed since the formation of the end of summer zone up to the day when the fish was injected. Thus, since the date of the injection had already been known, it was able to assume the day when the feature of circuli had turned from the summer type to the winter type.

By this way, the authors found out that the date when turning of the type of circuli occurred was from 1st to 30th of September. And the average growth rate of scale in winter was calculated for 0-year old fish and 1-year old one. It was 0.41 circulus per day for the former and 0.27 for the latter.

93. Studies on the abnormalities of scales in the tumour appeared on the skin of Japanese Common Goby. Ryushi ICHIKAWA (Journ. Jap. Ichthyol. **3**, 188-192, 1954)

Japanese Common Goby angled in Tokyo Bay, often has an ash-coloured tumour swelling on the skin. The author observed the scales involved in this tumour tissues to find out any particular influence of tumour cell on the scale. The results obtained were as follows:—

(1) Some of the ctenoid teeth of their scales have grown abnormally so long as to be two or three times of the normal teeth. And they were bent in their shape, sometimes like a snake. In this case, the apical area of scales were situated at nearly vertical position to the body surface because of being pushed up by overgrown connective tissue near the apical area of the scale.

(2) In an example of small regenerated scale, ctenoid teeth, arose directly from circuli, were observed. This seems to support the theory that the ctenoid teeth have developed phylogenically from circuli.

(3) Scales absorbed were often observed. Some of them lost their normal forms by their severe destruction.

94. Absorption of fish scale caused by starvation. Ryushi ICHIKAWA (Rec. Oceanogr. Works in Japan **1**, 101-104, 1953)

It is well known that age determination of a fish is possible by recognizing two kinds of peculiar features of the scale, i.e., the seasonal change of the width of circuli and the existence of absorbed or destructed lines which were caused by spawning or some other physiological condition of the fish in some particular seasons of the year. The author intended to clarify the cause of absorption of the scale by obtaining examples experimentally in relation to the spawning mark and annual ring formation.

Four individuals of carp were reared in a tank during colder half of a year. They were fed by a minimum amount of food just enough to maintain their lives, in order to keep them in starvation. These fish lost considerable weigth by mal-feeding (exp. $30\,g \rightarrow 13\,g$) and scales of them were taken for histological observation.

The scales were observed as follows:—The layer containing calcium salts in scale was found to be remarkably thinner than that of normal fish. As this thinner calcified layer was found to be the bony layer only, the calcium salts in the underlaying fibrillary plates must have been absorbed almost entirely by some physiological mechanism. From this fact, scale absorption in fish is not merely a result of the mechanical breaking off of the edge of scales when the body of the fish shrunk, but also a result of the disappearance of the calcium salts by absorption which would weaken the scale and bring about the mechanical breaking off.

The marginal parts and focus of the scale were absorbed and the fibrillary plates were naked out. The ridges of them were destructed and the disappearance or deformation was often observed.

The absorption of scale during mal-nutrition may be caused by the disappearance of calcium salts by certain physiological mechanisms, from the once calcified layers, and after that the destruction of scale may take place.

95. On the pull of fish caught by fish-hook. Yasuo OHSHIMA (Bull. Jap. Soc. Sci. Fish. **19**, 233-238, 1953)

Although it is a commonest phenomenon that a fish rushes violently when caught by a fish-hook, there does not seem to be any exact study on the strength with which such fish pulls the fishing tackle. This paper reports an experiment in which an attempt was made to measure that strength.

The apparatus used for this measurement was designed as follows: When a fish catches a hook and pulls the fishing tackle downward, the spring is stretched and the stress is recorded by the kymograph. The force with which a fish pulls the tackle downward, and the amount of work thereby done by the fish, are given respectively by $(F) = c.y + r.g = ky/n + r.g$ and $(W) = \{(y/n)^2 + r.g.y\}1/2$, where y is the displacement upward of the free end of the writing lever, and n, the magnification of the kymograph. c and r are constants proper to each spring, and they can be determined from the damped oscillation brought about by hanging a known weight on the hook. The friction between the recording paper and the pen has been found to be negligible.

The measurement was carried out at the Shinmaiko Aquarium of the Fisheries Laboratory, using several species of fish reared there as the material for this study.

Kymographic records obtained by this method are characterized by the major peaks of oscillation occurring at intervals and the minor peaks that follow each major one. Since the major peak, y, represents the maximum instantaneous force exerted by the fish, (F_{max}), and a major peak and the subsequent minor ones are taken into account in computing the amount of work done during the time they appear, $(\sum W)$, the feature of the pull can be expressed in the terms of (F_{max}), $(\sum W)$, and the time intervals of each major peak. While both (F_{max}) and $(\sum W)$ are necessary to express the strength of the pull, only (F_{max}) has been studied in some details.

In the rockfish, *Sebastiscus marmoratus*, (F_{max}) increases nearly proportionally with the body weight. Assuming this relation holds also in other species, (F_{max}) per 100 gr of body weight is adopted as the basis on which the forces of the instantaneous pull in different species of fish are compared.

96. A new device to measure the transparency of water in the fish-culture-pond. Nakaroku NAKAMURA (Bull. Jap. Soc. Sci. Fish. **19**, 1096-1099, 1954)

In the case of the fish-culture-pond hitherto we had no appropriate direct method to measure and denote the amount of phytoplankton which plays an important role in the productivity of the pond. Although it is a well known fact that a close relation exists between the water transparency measured by the Secchi disk and the amount of seston, such a large disk as the Secchi is not available in the shallow water of ordinary fish ponds. The author deviced a practical, convenient method for this purpose. Using a white china disk, 5 cm in diameter, the transparency is measured by dipping it in the water and reading the depth where it becomes invisible. A relationship represented by the hyperbolic curve exists between the observed transparency and the precipitation volume of the phytoplankton. Some transparency measurements in ponds at Ikawazu, Aichi-prefecture are shown.

97. On the development of *Loripes pisidium* (DUNKER), with special observation on the spawn. Coe SANG (Jap. Journ. Malacology **18**, 20-30, 1954)

The small bivalve, *Loripes pisidium* (DUNKER), is common along gravel sand above the lowest tide-marks on the coast near the Fishery Laboratory of Tokyo

University at Ikawazu, Aichi Pref. It is easy to rear the bivalve in the Laboratory tank and also observe their spawning.

Its breeding begins at the middle of June and continues until the end of October. In either sex the sexual element is slowly shot into water through the exhalent siphon which was extended to such a length as about two times that of the shell. In the male a continuous stream of milt scatters immediately into water, while in the female the eggs are spawn out with gelatinous substance, which is settled on the bottom in the shape of a pear-like gelatinous mass, and they are incubated in the mass through the developmental stages leading to the free swimming larvae.

The eggs are about 0.08 mm in diameter when extruded, and they develop into slowly revolving larvae in 15 hours after fertilization at temperatures ranging from 27° to 30°C. At this time the larvae are launched into the sea. The prodissoconch of independent individuals is complete in 20 hours. The larvae develop and increase in size to 0.21 mm and begin to crawl on the bottom by a slender foot. The maximum size of the larvae which the author could culture in tank was 0.22 mm in length and 0.19 mm in height.

98. On the sexual maturity of the sei whale of the Bonin water. Masaharu NISHIWAKI, Takashi HIBIYA and Seiji KIMURA (Sci. Rep. Whales Res. Inst. **9**, 165-177, 1953)

The sexual maturity of the sei whale of the so-called "southern type" is studied with the material secured in the Bonin whaling ground in May and June, for two years, 1952 and 1953.

On the basis of histological examinations, the weight of a single testis at its maturity is estimated as 0.74 kg, its fiducial range being 0.63-0.95 kg at the 5% level of significance. A male is regarded as sexually mature, if its both testes, in combination, weigh more than 1.5 kg (the double of 0.74 kg). The length of the male at sexual maturity, which is defined as the length corresponding to the percentage maturity of 75%, is statistically estimated at 40 ft and within the fiducial range of 39.8-40.9 ft at the 5% level of significance.

Whether a female is sexually mature or immature is determined from the presence or absence of a corpus luteum in its ovaries. The length of the female at sexual maturity, which is defined in the same manner as that of the male, is estimated at 41 ft and within the fiducial range of 39.5-41.9 ft at the 5% level of significance.

The present regulations forbid the floating factory whaling catcher to take sei whales under 40 ft long in the Bonin waters. This size limit is considered to be more stringent and protecting the whale stock more effectively, if not perfectly, than any other size limit now applied to various species of whales.

99. On the age-determination method of the toothed whale by the study of the tooth. Masaharu NISHIWAKI and Teiji YAGI (Proc. Jap. Acad. **30**, 399-404, 1954)

For the purpose of determining the age of the dolphin, *Prodelphinus caeruleo-albus* MEYEN, the authors attempted the following two methods. The first was to know the developmental process of the dentine by recording the time taken for it applying the *intra-vitam* staining method with lead acetate. The second was to determine the age by finding the relation between the number of the dentine layers

which appeared as periodic, striped pattern on the section of the tooth and the times taken by them.

1) The teeth of five dolphins, caught in 1951 and in 1952, were stained *intra-vitam* by injecting lead acetate into the dorsal muscle. The line characteristic to the deposition of lead was recognized as a distinct line in the section of the tooth. The results do not seem to give us a satisfactory conclusion on the growth rate as the number of successful samples was too few and surviving time of dolphins was too short. But they were able to prove that the method was applicable in the dose of 5 mg of lead acetate per Kg of body weight.

2) Neonatal line due to the poor nutrition appears in the dentine at the time of birth. The line can be used as a basis in age-determination.

3) The authors observed striped pattern in the dentines of 98 individuals caught in 1951 and 1952. The longitudinal sections were stained with alizarin red, and the number of dentine layers as they were stained deeply was counted. It is found that the relation between the body length (x) and the number of dentine layers (y) comes to an exponential growth formula. From the obtained date it is reduced to be a straight line given as follows.

$$\log y = -1.96 + 0.0133\,x\,.$$

It seems that the striped pattern was made by the influence of a periodical change of environment. It is surmised that the deep stained layer might be made twice a year, so it takes three or four years after birth to reach their sexual maturity in the present dolphins.

100. On nitrogen-gas contents dissolved in flowing water of artesian wells and springs (Relating to high supersaturation inducing the so-called "gas-disease" upon fishes). Yoshiyuki MATUE, Shuzo EGUSA and Aritsune SAEKI (Bull. Jap. Soc. Sci. Fish. **19**, 439-414, 1953)

Many springs and flowing wells are distributed in the northern vicinity of Odawara City, Kanagawa Prefecture. Throughout the four seasons, clear ground-water is continually flowing out of every well and spring, supplying water for domestic and industrial purpose.

Although the waters of this district are considered to be of good quality in their chemical properties, curious to say, fishes can hardly be kept alive in these waters. Fishes, when put into these waters just flowed out, soon fall in an unhealthy condition and can not survive long.

Gas contents were examined. Sufficient quantity of oxygen for the life of fish was proved to be dissolved in these waters, but nitrogen gas contents indicated abnormally high supersaturations.

After some experiments, we came to the conclusion that the death of fishes in these waters must have been brought about by the so-called "gas-disease" caused by the abnormally high supersaturation of the nitrogen dissolved in the ground-water. Experiments also teach us that the supersaturation values of the nitrogen above 130% in the water are fatal to fishes.

The gas disease of fish is considered to be pathologically similar to the caison-disease of man and give us many interesting and important problems for scientific investigation both from theoretical and practical point of view. The authors are now studying the subjects and the results of which will be reported in near future.

In this report the authors confined themselves in the quantitative determination of the nitrogen gas in the flowing water of the district. The summary is as follows:

(1) The flowing water of all the fifteen artesian wells and two springs which were visited and investigated showed the supersaturation of nitrogen gas. The values obtained ranged from 118 to 159%, but were most above 140%.

(2) It was observed that each well and spring has its specific supersaturation values of nitrogen stationary for a long period. The oxygen contents showed greater fluctuations compared with those of nitrogen.

(3) Two artesian wells, the waters of which were also known to induce the gas-disease upon fishes, were found in other districts (Ibaraki and Saitama Pref.) and their waters were investigated. Both wells showed very high supersaturations of dissolved nitrogen (146 and 161%).

101. The feature of plankton found in the surrounding area of Myojin-sho. Yoshiyuki MATSUE and Yuzo KOMAKI (Journ. Tokyo Univ. of Fisheries **40**, 22-25, 1953)

During the First Survey of Myojin-sho by Shinyo-maru (21-24 September, 1952) plankton collections were carried out at four stations around Myojin-sho. All of the thirteen samples collected were examined quantitatively.

The communities of the collected plankton showed purely zooplanktonic and the most prominent member was Copepoda with a great number of species. Exactly we could identify 25 genera including 65 species of Gymoplea and 11 genera including 36 species of Podoplea.

At St. 3, the nearest station to the crater (about one nautical mile away from the crater), large amount of pumice fragments were collected mixing with plankton in every layer, and not only the quantity of plankton in each layer showed conspicuously small value compared with other stations, but also those materials had colors of yellowish-brown, brown or grey and included some shrinked or collapsed organisms. These damaged individuals were found mainly of those large formed animals having weak body structure such as *Sagitta, Oikopleura, Salpa,* Medusae, and *Eucalanus, Calocalanus, Haloptilus, Copilia* in Copepoda.

Although St. 1 was amidst the yellow-colored area caused by the erupted substance, the materials did not show any abnormal appearance, and they did not differ from the materials of St. 2 that was located outside of the yellow-colored area.

On the other hand in the materials collected at St. 4, the station near Bayonase Rocks, we observed the damaged animals with similar feature to those of St. 3 and conspicuous amount of detritus too.

The prominent species among Copepoda throughout four stations were as follows: *Calanus darwinii, C. tenuicornis, Eucalanus attenuatus, E. mucronatus, Euchaeta longicornis, E. marina, Scolecithrix danae, Copilia mirabilis, C. quadrata, Setella gracilis* etc.

Such species as *Calanus pauper, Clausocalanus arcuicornis, Paracalanus aculeatus* and *Corycaeus gibblus* could be hardly observed at St. 3 especially in the layers deeper than 50 m. This could apply to *Mecynocera clausi* too, but it did not appear at St. 1 at all.

Sagitta, Salpa, Oikopleura and *Cypridina* showed prominent appearance in zooplankton other than Copepoda at each station, and next came Mysis-larva and Polychaeta-larva. *Lucifer* could not be seen at St. 3. In 100–50 m layer at St. 3, larger forms of Polychaeta —*Tomopteris, Callizona* and *Vadis* etc. were more conspicuous than at other stations.

102. An experimental note on the influence of light on the development of spores of algae. Seibin ARASAKI (Bull. Jap. Soc. Sci. Fish. **19**, 466-470, 1953)

The spores of several algae (including 4 spp. in Chlorophyceae, 3 spp. in Phaeophyceae and 3 spp. in Rhodophyceae) were cultured in the laboratory under different light-conditions as follows:

1) Concerning light intensities: A.—in full sunlight avoiding the direct rays, B.—under a sheet of white cotton-cloth, and C.—under a shade of three layers of white cotton-cloth or a layer of black cloth.

2) Concerning quality of light: under a colour filter using solutions of red, brown, green, blue, and violet colour pigment.

3) Concerning duration of light: A.—long-day of 24 hours, B.—normal-day of 10-12 hours, and C.—short-day of 8 hours.

Results may be summarized as follows:

A). In dark conditions, the spores of green algae did never germinate nor set in cell-divisions for more than 1.5 years, while most spores of brown or red algae germinate slowly. In decreased light, the growth of the sporelings of green algae were greatly retarded, while those of brown or red algae were rather accelerated. But one exception in green algae was observed; i. e. the sporelings of *Monostroma* grew slowly in decreased light for about two weeks after germination, but thereafter they set in a faster growth than in full sunlight.

B). The sporelings of green algae grew more rapidly under yellow, red, or blue light than under brown or green light.

C). The spore of *Enteromorpha* developed more rapidly in the long-day condition. With *Monostroma,* however, the development in the earlier stage were faster in the normal-day condition, but after a while more rapid growth and richer formation of spores were obtained in the short-day condition.

103. On the geographical distribution and the age of the specialization of *Dichotomosiphon tuberosus.* Seibin ARASAKI (Science [Japan] **23**, 530-531, 1953)

The *Dichotomosiphon tuberosus* ERNST is a rare green alga (Siphonales, Vaucheriaceae) which grow in fresh-water distributing discontinuously in those restricted habitats as follows; in Europe—rare, a few stations in Switzerland, southern France, and Bohemia: in North America—not rare, several stations in the north around the lake districts, and one place each in Georgia, Florida, and Texas in the south: in Asia—rare, Kwangtung China, and Okinawa Island.

These three districts are separated remotely from one another, not only in distance but also in topographical or climatic conditions. As the frond of the present alga is minute and much sensitive against desiccation, it may be unnatural to assume the transplantation or migration through the air, but it may be rather natural to assume the the geo-historical origin of the discontinuity of the geological distribution.

According to the palaeogeologists (SCHUSTER, GRABAU, etc.), during the Palaeozoic and Mesozoic eras there was a wide spreading inland-sea which linked the Pacific and the Atlantic Oceans across the land parts of present Eurasian and North American Continents: water of the ancient sea might be more dilute, and the climate of the earth was moderate even in the vicinity of the arctic regions.

From these, it is suggested that the *Dichotomosiphon* might distribute widely along the shallow shores of that inland-sea, and the present habitats, above said, may

be mere relics of the common occurrences in the remote antiquity. And it is also suggested that the creation of the species *D. tuberosus* might happen during the late Cambrian and the early Silurian periods when all the separated habitats of the present times, especially those in North America, had been connected with one another by the epeiric shallow shores (after palaeogeographical maps in DUMBAR 1949).

104. On the life history of *Porphyra tenera* KJELLM. Seibin ARASAKI (Science [Japan] **24**, 152-153, 1954)

The *Porphyra tenera* begin to develop in autumn, grow luxriantly during winter and spring, and disappear gradually in summer. They propagate by the 'monospores' and the 'carpospores': the former are formed asexually mostly in the younger thalli, while the latter are formed sexually in abundance during the harvest seasons of the *Porphyra*. In the laboratory cultures, although all monospores develop directly into the normal thalli, a few of the carpospores grow normally. Most of them produce the branched filamentous germlings, or remain ungerminated, as many Japanese investigators regarded it as abnormal or pathological. As to the fate of the carpospores or the life history of *P. tenera*, two different opinions have prevailed in Japan. 1) that the carpospores develop directly and persist through the summer as minute plant-lets reproduced by monospores, and these develop normally in autumn (UEDA, etc.), and 2) that the carpospores remain in dormant throughout the summer season and give rise to fresh crops of *Porphyra* in autumn (KUNIEDA, etc.). In spite of these, the origin of the autumnal spores remains uncertain.

After DREW (1949), who introduced the *Conchocelis*-phase in the life cycle of *P. umbiricalis*, the writer re-examined and certified her observations. The filamentous germlings of carpospores survive through the summer and produce a number of monospores which germinate into normal thalli in autumn when the temperature becomes lower than 25°C. The external form of the filamentous germling varies with the substrata on which the carpospore fixed. Whether the carpospores may germinate normally or abnormally, or remain in dormant, it fluctuates with the environmental conditions or with the varietal properties of the plant. Meanwhile, there is reason to believe that the *Porphyra* is a haploid form and the 'monospore' represents a mere accessory method of reproduction, or a type of vegetable propagation: and that in the life cycle of the *Porphyra* there are no regular alternation of generations as in the *Ulva* or the *Laminaria*.

It appears to be probable that the *Porphyra* spend the summer as minute thalli, as *Conchocelis*, or as dormant spores, one or the others at places preponderating; in the northern regions where the 'round variety' predominates and the mean water temperature during the summer time does not exceed 25°C the first form preponderates, while in the southern regions where the 'long variety' predominates and the water temperature during summer exceeds greatly over 25°C, the latter two forms, especially the *Conchocelis* preponderates.

105. The scientific foundation on the culture technique of the 'Asakusa-nori', *Porphyra tenera* KJELLM. Seibin ARASAKI (Science [Japan] **24**, 218-223, 1954)

In order to cultivate the 'nori', *P. tenera*, the ground are prepared in autumn (especially from late September to middle October) by planting the 'hibi' in the shallow sea where the plants are out of sight. Then, innumerable spores of *Porphyra*

appear in the sea, and settle themselves on the 'hibi' developing into the new crops of the 'nori', and the harvesting of it continues from November till the end of March.

According to the recent investigations on the life history of the 'nori', it is assumed that the main resources of the autumnal spores are in most cases in the *Conchocelis* which persist through the summer seasons on the bottom of the shallow sea, and produce a number of monospores in autumn. Although many living *Conchocelis* are obtained even in tidal regions from January till July, most of them die out during the hot summer seasons remaining those which stay in the submerged sublitoral places. Besides, it is also assumed, from the oceanographical viewpoints, that the seawater is apt to be more turbulent as the weather become cooler and stormy. In such conditions, innumerable monospores which are produced on the *Conchocelis* float up, probably by the up-welling movement of the bottom water of the sea, and then they encroach into the culture ground with the rising current of the flood tide, attaching themselves on the newly planted 'hibi'.

Among the sporelings found on the 'hibi', there are, at least, five morphologically different types which are separable from one another by the process of making thallus and the size of the plant producing the monospores; and from the economic viewpoints, it is preferable to separate them into the 'early variety' and the 'later variety' according to the harvest time.

The growth ratio of the plants depend greatly on the environmental factors, such as the air or water temperature, the concentration or nutrient content of sea-water, the duration of emersion or submersion with the tide, and so on. Among these, the last case or the duration of emersion or submersion is able to be controlled easily by mere raising or lowering the 'hibi'. It is said that the 'nori' exhibit healthy development in the tidal levels where they are always kept emerging from the water for about 3½ to 4 hours every day.

The harvest of the 'nori' used to suffer from disastrous damages in the course of cultivation; among these, the 'red wasting' and the 'white wasting' diseases are most injurious. The former is a parasitic disease caused by the *Pythium* n. sp., while the latter is a non-parasitic, caused physiologically by constant subemergence of the frond. In order to keep the plants healthy from those disease, it is preferable to hold the 'hibi' raising about 35-50 cm higher than the original level during the November and the December months, when the sea level at ebb-tide for the day become higher than that in autumn.

106. The morphogeny in the Phaeophyta. Seibin ARASAKI (Biological Science, 6, 58-62, 1914)

Among the members of Phaeophyta, the simplest types are branched, uniseriate filamentous, and sometimes microscopic, while at the other extreme there are morphologically elaborate forms, such as the *Macrocystis* and the *Sargassum* which in size, complexity of structure, and degree of external differentiation surpass all other algae. The internal structure or tissue may be classified into the following fundamental types:

(1) Sympodially branched, uniseriate threads.
  (a) Uniaxial forms.—*Ectocarpus*, etc.
  (b) Multiaxial forms.—*Tinocladia*, *Eudesme*, etc.
(2) Monopodially branched, uniseriate threads.

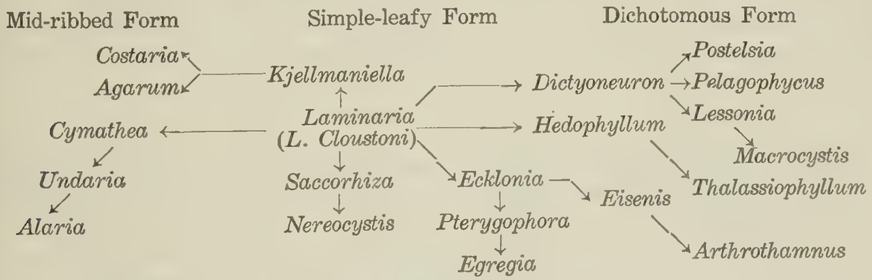
(a) Uniaxial forms.—*Tilopteris*, etc.
(b) Uniaxial forms with cortical threads.—*Acrothrix, Desmarestia*, etc.
(c) Multiaxial forms.—*Nemacystus, Sporochnus*, etc.

(3) Uniseriate axial thread with cortical cells which are transformed from knob-like outgrowths around the axis.—*Dictyosiphon*, etc.

(4) Parenchymatous structure, made by successive intercalary longitudinal cell-divisions beginning in somewhat grown-up uniseriate germling.
(a) Longitudinal divisions occur in various directions, becoming in solid filamentous thalli.
i) Uniaxial forms.—*Sphacelaria, Stictyosiphon*, etc.
ii) Multiaxial forms.—*Cutleria, Chnoospora*, etc.
(b) Longitudinal divisions occur mostly in one direction, becoming in expanded leafy thalli.—*Punctaria, Scytosiphon*, etc.

(5) Parenchymatous structure, made by longitudinal divisions occurring in earliest stage of germination: external differentiation in the leaf, the stem, and the stipe are distinct in mature forms.
(a) Longitudinal divisions occur in various directions, becoming in woody forms.—*Sargassum*, etc. Fucales.
(b) Longitudinal divisions occur mostly in one direction, becoming in leafy or its modified forms.—*Dictyota, Laminaria*, etc.

Among those, the types 1, 2, 3, 4-a, and 5-a become into filamentous, columnar, dendroid or woody forms, while the types 4-b, and 5-b into leafy or its modified ones. It seems reasonable to assume the morphological advancement in the former case, progressing step by step from the 1 to the 5-a, and the other subsidiary progression in the case of 4-b and 5-b; separating the Phaeophyta into two groups, i.e. the 'dendroid or columnar form' and the 'leafy or thalloid form'. At the summit of each form situates the Fucales or Laminariales. In Fucales the embryo is cylindrical with apical meristems, and the branches initiate as lateral outgrowths of the stalk, some of them especially that which situates at the terminal end become flat transforming in the leaf. In Laminariales, the embryo is flat foiiform with intercalary meristems, and the stalk or stem is transformed by splitting and thickening of the primary blade. The elaborate forms of the members of Laminariales may be classified as follows:



107. On the application of ureal fertilizer to algae. Koji NOZAWA (Studies on Foliar Application 81-83, 1954)

The nitrogen is most important to the growth of cultivating algae, hence, some investigations have since been carried out using some nitrogenous fertilizers (such

as potassiumnitrate, ammoniumnitrate, ammoniumsulfate and urea) in the field with a few successful results. In his present investigation the writer used the urea as a fertilizer to algae, and obtained an excellent result.

After submerging the *Ulva pertusa* in 0.01% solutions of potassiumnitrate, ammoniumnitrate, ammoniumsulfate, and urea for two days, the amount of nitrogenous compounds within the frond were examined. The increase of proteic nitrogen, amino acids, and chlorophyll were greater in the urea than the others, while those of the free ammonia and non-proteic nitrogen were remarkably smaller than in the ammonium salts. In the potassium nitrate, the increasing ratio of those nitrogenous compounds were poor.

When the fronds was submerged in 0.1% solutions for 30 minutes, the rapid absorption of the urea was ascertained by the increase of chlorophyll. In the case of the ammonium solutions, chlorophyll quantity of the frond decreased, probably by the injurious effect of the freed ammonia. No changes of the nitrogen quantities was observed in the potassium nitrate.

From these, it may be suggested that the urea is absorbed rapidly and more effectively; the potassium nitrate is effective but absorbed slowly; and the ammonium salts are absorbed rapidly but rather injurious.

To solve the technical problems for the cultivated *Porphyra tenera* experiments were carried out by different methods, such as spraying in the emerged condition, or culturing in the continuous subemergence for long time (a few days) or short time (10-30 minutes); and in each case the increase of total nitrogen was observed.

108. Synthesis of vitamin A and its related compounds. III. Takajiro MORI and Kazuo SHIRAI (Vitamins **6**, 716-718, 1953)

As the side chain, 1-oxy-3-pentenin-(4) (I) was prepared by shaking 3-oxy-3-methyl-pentenin, the addition product of methyl vinyl ketone and acetylene in liquid ammonia in the presence of lithium, with dilute H_2SO_4 anr rearranging the –OH group from 3 to 1.

β-Ionylidenformaldehyde was condensed with (I) by means of GRIGNARD's reaction and partially hydrogenated similarly to the previous report.

The hydrogenated compound was partially acetylated with acetyl chloride in the presence of pyridine. The reaction product, 1-acetoxy-3,7-dimethyl-6-oxy-9-[2,6,6,-trimethyl-cyclohexen(1')-yl]-nonatrien-(2,4,7), was dehydrated by iodine and purified by chromatography on activated alumina. The final reaction product gave CARR-PRICE reaction and showed absorption maximum at 325-6 $m\mu$, the maximum of vitamin A and its esters.

109. Synthesis of vitamin A and its related compounds. IV. On the biological activity of synthesized vitamin A acetate. Takajiro MORI and Shōji KŌNOSU (Vitamins **6**, 719-720, 1953)

The synthesized vitamin A acetate which was purified by chromatography, was assayed the biological activity for rats according to the standard method of U.S.P., and proved to have the potency more than 8,500 U.S.P. units.

110. Animal protein factor (APF) and vitamin B_{12} in marine products. I. Aquatic animals. Yoshiro HASHIMOTO, Shigehide YAMADA and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. **19**, 135, 1953)

The vitamin B_{12} concentrations in various organs of nine species of common edible fish and six species of the lower animals, such as shellfish, cuttle-fish and shrimp, were determined by Hutner's *Euglena* method. These marine animals were found to be the good source of the vitamin and the livers of fish and shellfish were especially rich in it.

Using young chicks, the growth-promoting activity of the solubles was also examined, which were prepared from various parts of the fish, such as bonito, yellow-fin albacore, cuttlefish, oyster and baby clam. On the supplement of these solubles to the all plant protein ration, young chicks showed the considerable growth response, demonstrating the presence of AFP in the solubles. However, it is noticeable that cuttlefish meat solubles were inactive, although they contained the considerable amount of vitamin B_{12}.

111. Effect of antibiotics and vitamin B_{12} supplement on carp growth. Yoshiro HASHIMOTO (Bull. Jap. Soc. Fish. **19**, 899, 1953)

In the first experiment, young carps (four weeks old) were fed for about eight weeks on the all vegetable ration consisting of soybean oil meal, yellow corn meal, soybean oil, salts and vitamins except B_{12}. In the second experiment, one year-old carps were fed for eight weeks on the soybean meal and the silkworm pupa protein diets, which were similar to the above in their composition.

These basal diets were supplemented respectively with vitamin B_{12} and antibiotics, such as aureomycin, streptomycin and terramycin.

No growth response was observed on the carps fed on vitamin B_{12}, and the carps fed on no vitamin B_{12} were found to contain an ordinary level of the vitamin in their bodies. The fact may indicate that carps are able to supply vitamin B_{12} for themselves, perhaps by the aid of intestinal microorganisms.

Antibiotics tested, both alone and together with vitamin B_{12}, showed no remarkable growth stimulation for carps, differing from the case of chicks and other domestic animals.

It was revealed that quite another APF factor differing from vitamin B_{12} seems to be necessary for carps.

112. An assay method for freshness of fishes by the estimation of pH value. Makoto YAMAMOTO and Masanori SONEHARA (Bull. Jap. Soc. Sci. Fish. **19**, 761-765, 1953)

Present paper concerns with the accuracy and usefulness of pH determination in terms of freshness of fishes. A special glass electrode connected with an amplifier capable of reading exactly 0.50 mV intervals was used. The results of determination on the pH values of 28 kinds of fishes may be summarized as follows:

(1) The pH value of fish meats may be adopted as a criterion of the freshness of fishes to some extent.

(2) However, the pH value varies according to the part of a body. And some divergencies are also observed according to the fishing season and species of fishes.

(3) The pH value of fish meats at the early spoilage was 6.85 in the fishes of white meat and 6.27 in those of red meat.

113. Chemical studies on the red muscle ('Chiai') of fishes. I. Occurrence of arginase in the red muscle of fishes. Fumio MATSUURA, Haruo BABA and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. **19**, 893, 1953)

We cannot obtain much information about the arginase activity of the muscle of animals, especially of fishes. In 1924, HUNTER and DAUPHINEE reported the presence of arginase in the muscle of dog-fish and only traces in the muscle of herring. But there is no description about the kind of muscles in this report.

Here, attempts have been made to compare arginase activity of the white (lateral) and the red ("chiai") muscles of fishes. Glycerol extracts of fish muscles was allowed to act upon arginine and urea iberated was estimated by means of xanthydrol or urease method.

Results were following:

(1) In the white muscle of the fishes, arginase was absent or only in traces, if any, but in the red muscle it was found to be present.

(2) However, in some kinds of the scombroid fish, such as tunny, there are two kins of the red muscle, one is "superficial" and the other "deep-seated". These two kinds of the red muscle of *Katsuwonus vagans* and *Parathunnus sibi* were examined for arginase activity. The superficial red muscle did not contain arginase like the white muscle, or if any, very little, while the deep-seated red muscle contained it definitely.

(3) And then, effects of Mn^{**} ion on the arginase activity of fish muscles were examined, by adding $MnSO_4$ to the reaction system at the levels of 0.001 and 0.0005 M. concentration. Even on the addition of $MnSO_4$, the arginase activity was not detected in the white muscle, and the activating effect was uncertain in the red muscle.

114. Studies on the whale oil. I. Properties of oils contained in various parts of a whale body. Part 1. On the sei-whale (*Balaenoptera borealis*) and fin whale (*Balaenoptera physalus*). Masamichi SAIKI and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. **19**, 611-613, 1953)

On the sei-whale and fin whale, considerable differences were found in chemical nature of the fats from different parts of a body. Iodine value of oils from sei-whale are shown as follows: dorsal blubber 109.0, blubber of ventral grooves 116.1, muscle 95.8, tongue 94.2, stomach 89.2, intestine 112.9, heart 145.4, kidney 112.4, spinal cord 120.3. The properties of the oil from *Euphausia superba* in the stomach of fin whale are shown in table below.

neutral fat:	n_D^{40} 1.4666, acid value 116.4, unsapon. matter 6.91%
unsapon. matter:	n_D^{40} 1.4867, iodine value 102.3
mixed fatty acids:	n_D^{40} 1.4550 iodine value 143.7, neutralization value 191.0

115. Studies on the whale oil. II. Properties of oils contained in various parts of a whale body. Part 2. On the sperm whale (*Physeter catodon*, L.). Masamichi SAIKI and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. **19**, 614-618, 1953)

The iodine value, sapon. value and amount of unsaponifiable matter of the fat

shows remarkable differences each other as shown in table below. The properites of the unsaponifiable matter, mixed fatty acids, solid and liquid fatty acids were also reported in the original paper.

Table 1. Properties of oils from a sperm whale.

Parts of the body	$d^{25°}_{4°}$	$n^{40°}_{D}$	Acid Valve	Sapon. Value	Iodine Value	Unsapon. Matter %	Vitamin A (I.U.)
Head cavity	0.8711	1.4498	0.47	137.81	48.93	47.92	141
Blubber	0.8733	1.4561	0.41	127.35	80.21	38.63	234
Bone (costae)	0.8787	1.4553	0.87	135.09	70.02	33.81	516
Spinal cord	0.8754	1.4542	38.41	140.06	70.35	33.60	503
Meat (muscle)	—	1.4559	24.09	152.47	76.47	25.04	449
Heart	0.8872	1.4552	34.16	157.90	68.07	23.51	310
Large intestine	—	—	45.91	152.97	77.85	15.47	—
Small intestine	—	—	62.80	159.33	77.34	15.06	—
Liver	—	1.4702	23.93	187.34	104.70	11.61	27,700
Liver*	—	1.4751	28.26	—	104.37	—	48,300

* other whale

Table 2. Properties of oils from a head cavity of sperm whale.

Parts of the cavity	Refractive index	Acid value	Sapon. value	Iodine value	Unsapon. matter %
Inner part	n^{40}_{D} 1.4470	0.78	135.8	40.4	55.56
Outer part	n^{60}_{D} 1.4400	9.16	139.2	52.3	49.30

116. Studies on the whale oil. III. Properties of oils contained in various parts of a whale body. Part 3. On the foetus of sperm whale (*Physeter catodon,* L.). Masamichi SAIKI and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. 19, 619-621, 1953)

The authors studied the oils from foetus of the sperm whale from the point of view of fat metabolism, as the foetus takes the nutrition from the mother's body and not from the food. The results obtained show some interesting facts; i. e. the content of the deposit fat are very low, head oil does not exist in head oil organ, and only a small quantity of unsaponifiable matter is seen in the oils of foetus.

117. Studies on the whale oil. VIII. Fatty acids composition of the pacific beaked whale (*Berardius bairdii*) oil. Part 2. On the blubber oil. Masamichi SAIKI (Bull. Jap. Soc. Sci. Fish. **19**, 809-812, 1953)

The quantitative composition of fatty acids of pacific beaked whale blubber oil was determined. The content of the saturated acids was 10.14% and the unsaturated acids 89.86%. The saturated fatty acids were mainly constituted of palmitic, myristic and stearic acids, whereas the unsaturated consisted of monoethenoid acids of C_{20}, C_{18}, C_{22}, C_{16}, C_{14}, and a little quantity of C_{20}, C_{22} acids which were more unsaturated than monoethenoid. The quantity of C_{20}, C_{22} acids were comparatively large. The

fatty acid composition of this blubber oil showed a considerable difference from that of the head and jaw oil reported previously.

Table 1. Composition of fatty acids of the pacific beaked whale blubber oil.

	C_{12}	C_{14}	C_{16}	C_{18}	C_{20}	C_{22}
Saturated fatty acids	0.34	4.02	4.48	1.30	—	—
Unsaturated fatty acids	—	2.08	9.31	26.90	38.50	13.07
		(−2H)	(−2H)	(−2H)	(−2.14H)	(−2.6H)

118. Studies on the whale oil. IX. Fatty acids composition of the pacific beaked whale (*Berardius bairdii*) oil. Part 3. On the viscera oil. Masamichi Saiki (Bull. Jap. Soc. Sci. Fish. **19**, 1028-1031, 1954)

The content of the saturated fatty acids was 10.6% and the unsaturated acids 89.4%. The saturated fatty acids consisted mainly of myristic, palmitic and a little quantity of stearic acids. The unsaturated fatty acids consisted of monoethenoid acids of C_{20}, C_{18}, C_{16}, C_{22}, C_{14} and a little quantity of C_{18}, C_{20}, C_{22} acids which were more unsaturated than monoethenoid. (Tab. 1) The fatty acid composition of this viscera oil showed a considerably difference from that of the head—jaw oil, but the composition resembles to that of the blubber oil.

Table 1. Composition of the fatty acids of oil from viscera of the Pacific beaked whale.

	C_{12}	C_{14}	C_{16}	C_{18}	C_{20}	C_{22}
Saturated fatty acids	0.71	5.13	3.71	1.04	—	—
Unsaturated fatty acids	0.07	2.97	10.88	29.69	39.52	6.28
	(−2H)	(−2H)	(−2H)	(−2H)	(−2.14H)	(>−2H)

119. Studies on the molecular distillation of whale liver oils. III. Takeshige Yamakawa, Shōji Kōnosu and Takajiro Mori (Bull. Jap. Soc. Sci. Fish. **19**, 155-158, 1953)

On molecular distillation of several whale liver oils, total amount of recovered vitamin A assayed by Oser's spectrophotometric method, exceeded 100%, mean 150.8% and the maximum 223% of the original oil.

The biological activities of vitamin A in fin whale liver oil and its distillate were assayed by the standard method of U.S.P.

The results obtained are summarized as follows:

(1) The biological potency of the whale liver oil was found to be higher than that assayed by spectophotometric method of Oser, whereas the distillate showed nearly the same potency biologically as spectrophotometricaly.

(2) The total amount of vitamin A recovered in the distillates of molecular distillation amounted to 223% spectrophotometrically, but it was found to be 185% biologically. This value was still higher than those reported previously by other authors.

V. FORESTRY

Abstract Nos. 120—171

120. The wood anatomical characters of *Styracaceae* in Japan. Taizo INOKUMA, Ken SHIMAJI and Syoji SUDO (Bull. Tokyo Univ. Forests **45**, 181-201, 1953)

Out of the members of Fam. *Styracaceae* two genera, six species and some varieties are found in Japan. A wood anatomy was performed on the six species: *Styrax japonicus* S. et Z., *S. Jippei-Kawamurai* YANAGITA, *S. Obassia* S. et Z., *S. Shiraianus* MAKINO, *Pterostyrax corymbosus* S. et Z., and *P. hispidus* S. et Z. Five foreign species of four genera were compared, namely *Styrax formosanus* MATS., *S. suberifolius* HOOK et ARN., *Alniphyllum pterospermum* MATS. from Formosa, *Halesia calorina* L. from North America, and *Sinojackia xylocarpa* HU. from East China.

The number of solitary pores and multiple pores were observed and the difference in percentages revealed to the authors that *Pterostyrax* species had more solitary pores than *Styrax* species, *Pterostyrax hispidus* had more solitary pores than *P. corymbosus*. All of the Japanese *Styrax* species showed almost the same results compared with the foreign *Styrax* species.

A few abnormal structures were observed. It is important that the spiral thickenings of vessels had never been described on genus *Styrax* and it was rarely observed in the tails of vessels in *S. japonicus* and *S. Obassia*. Sometimes one or two lateral scalariform perforations were found on the side walls of vessels of the majority of species. The majority of the main wood-anatomical characteristics of the four Japanese *Styrax* species showed a close relation. It will be said that they belong to one group, separating them from the foreign *Styrax* species.

The two investigated species of genus *Pterostyrax* were also very similar in the main wood-anatomical characteristics, and so it seemed unsuitable to set up genus *Decavenia* for *P. hispidus* S. et Z. separating from genus *Pterostyrax* on the wood-anatomical stand point of view, although Dr. KOIDSUMI had asserted the genus *Decavenia* on the taxonomical stand point.

121. Anatomical studies on the wood of Japanese *Quercus* I. On subgenus *Lepidobalanus* (Nara group). Ken SHIMAJI (Bull. Tokyo Univ. Forests **46**, 193-210, 1954)

As the first step of the wood-anatomical investigations on genus *Quercus*, eight Japanese species of subgenus *Lepidobalanus*, i.e. *Q. acutissima* (Kunugi), *Q. variavilis* (Abemaki), *Q. phylliraeoides* (Ubamegashi). *Q. crispula* (Mizunara), *Q. aliena* (Naragashiwa), *Q. mongolica* (Mongorinara), *Q. dentata* (Kashiwa) and *Q. serrata* (Konara), are studied wood-anatomically, and:

(1) Minute descriptions on the wood-anatomical characteristics of each species are given.

(2) The processes of the ontogenetic development of the primary broad rays are studied, and three types of the developmental processes are known, each one of which

is characteristic to the three sections of the Japanese *Lepidobalanus* species respectively.

(3) Japanese species of subgenus *Lepidobalanus* are separated into three groups, which are correspondent to the three sections offered taxonomically, on the base of the anatomical characteristics of the adult wood as well as on the above mentioned ray-developmental processes. That is to say, the wood of section AEGILOPS is ring porous, and has thick-walled and rounded summer wood vessels and compound broad rays; that of section ILEX is radial porous, and has aggregate broad rays; and that of section PRINUS is ring porous, and has thin-walled and angular summer wood vessels and compound broad rays.

(4) On the other hand, there occur some confusions between wood-anatomical- and taxonomical separations when the other two subgenera, i.e. *Cyclobalanopsis* and *Erythrobalanus,* come into considerations. Namely, section AEGILOPS and section ILEX of *Lepidobalanus* have the wood of *Erythrobalanus* type and *Cyclobalanopsis*-type respectively, while section PRINUS alone has the wood of the typical *Lepido balanus* type. These confusions may suggest the necessity of reconsiderations on the taxonomic segregation of the species of genus *Quercus* as a whole.

(5) Finally, a key to the above mentioned eight species based on the wood anatomical characteristics is presented.

122. Three *Athyrium* spp. from Hachijō Island. Satoru KURATA and Takehisa NAKAMURA (Journ. Jap. Bot. **28**, 308-310, 1953)

In the summer of 1952, three fern species belonging to genus *Athyrium* were collected in Hachijō Island. Among them, *Athyrium iseanum* ROSENSTOCK and *A. Vidalii* NAKAI have never been reported from the Izu Archipelago including Hachijō Island, while, in this archipelago, the other *Athyrium otophorum* KOIDZ. was only once found by Mr. KURIHARA in Miyake Island about fifteen years ago. It is remarkable that in Hachijō Island *Athyrium iseanum* and *A. Vidalii* were found only in the crater-basin of Mt. Hachijō-fuji of rather recent eruption. This fact tells the spores of these ferns were disseminated to this island from the Izu or Bōsō Peninsula or western Japan by wind in recent years.

123. Ferns from the Miura Peninsula, Prov. Sagami. Satoru KURATA (Amatores Herbarii **50-51**, 11-15 1953)

This paper deals plant-geographically with several remarkable ferns growing wild in the Miura Peninsula (Kanagawa Prefecture), criticizing some ferns which may have been erroneously identified. It is certain that *Cyrtomium macrophyllum, Hypolepis punctata, Rumohra pseudo-aristata* and *R. simplicior* are wild but scarce in this area. On the other hand, the occurrence of such species as *Colysis elliptica, Dryopteris sparsa, Lepisorus annunifrons, Mecodium Wrightii, Physematium manchuriense, Rumohra amabilis, Stenoloma littorale* and *Woodsia polystichoides* in this peninsula, though reported as growing wild there, is very questionable. In " Enumaratio Plantarum Japonicarum II (1876)", *Colysis elliptica* was reported as wild near Yokosuka, a central city of this peninsula, by Franchet and Savatier. But their report is not reliable concerning the localities of several plants. For example, it is very strange that *Aspidium muticum* FR. et SAV. and *Asplenium melanolepis* FR. et SAV. of northern Japan should have their type localities near Yokosuka situated in the midst of the warm temperate region, where we have not been able to find them until to-day. Although the fern flora of the Miura Peninsula is mostly composed of ferns common

to the coastal region as supposed from its topography, such mountain ferns as *Athyrium clivicola*, *Dryoathyrium Okuboanum*, *Dryopteris sacrosancta* and *Leptorumohra Miqueliana* are found in this area, though scarcely.

124. Notes on Japanese ferns (1). Satoru KURATA (Hokuriku Journ. Bot. **3**, 35-37, 1954)

From the taxonomical and geographical view-points, critical notes on *Cyrtomium Fortunei* var. *intermedium*, *Cyrtomium macrophyllum*, *Cyrtomium tukusicola*, *Diplazium chinense* and *Pteris natiensis* are given.

125. Miscellaneous notes on the flora of the Izu Archipelago (I). Satoru KURATA (Amatores Herbarii **52-53**, 17-20, 1954)

Athyrium clivicola, *Athyrium deltoidofrons*, *Athyrium yokoscence* var. *dilatatum* and *Dryopteris sacrosancta* are new to the flora of this archipelago. Several noteworthy localities of *Athyrium yokoscence*, *Dryopteris saxifraga*, *Dryopteris varia* and *Viola Maximowicziana* are reported.

126. *Diplomorpha ellipsocarpa* is the same species with *D. trichotoma*. Toshio HAMAYA (Journ. Jap. Bot. **29**, 121-123, 1954)

Since the time of MAXIMOWICZ (1892), it has been a leading opinion to separate *Diplomorpha ellipsocarpa* (MAXIM.) NAKAI from *D. trichotoma* (THUNB.) NAKAI. The distinguishing points are found in the colour of branchlets and peduncles, the size of leaves, the number of flowers in an inflorescence, the length of an ovary stipe, and the shape of a fruit. There are, however, continuous variations between the typical forms so that the difference must be resulted by epharmonism.

127. Wood-rotting Fungous Flora in the Ozegahara Moor and its Adjacent Districts. Toshio SASAKI (Scientific Researches of the Ozegahara Moor 539-552, 1954)

The list of wood-rotting fungi contains all identified species belonging to *Auriculariaceae*, *Tremellaceae*, *Caloceraceae*, *Corticiaceae*, *Meruliaceae*, *Hydnaceae* and *Polyporaceae*, collected in the Ozegahara Moor and its adjacent districts. These fungi are 79 species belonging to 38 different genera. From the taxonomical and geographical points of view, some critical notes of the new or noteworthy species are given. Among them, *Laetiporus sulphureus*, *Phellinus Hartigii*, *Phaeolus Schweinitzii*, *Fomitopsis officinalis*, *Cryptoderma pini*, *Elfvingia applanata*, *E. Tsunodae*, *Hapalopilus croceus*, *Inonotus dryadeus*, *I. hispidus*, *Hericum Erinaceus*, *Grifola frondosa* *Fomitopsis ulmaria*, *Steccherinum septentrionale* and *Fuscoporia obliqua* are the important destroyers of living trees.

The affinities of wood-rotting fungous flora in this area should be chiefly with that of climax forests in Hokkaido. Considering from the geographical position, however, some southern species have good reason to be found in this area. Also, it is distinct that the climax wood-rotting fungi are present and the disclimax species are not or scarcely present in this area.

128. Wood-rotting Fungi collected in the Tokyo University Forest in Chiba Prefecture. Toshio SASAKI (Bull. Tokyo Univ. Forests **46**, 181-192, 1954)

The list of fungi included herein contains all identified species belonging to *Dacryomycetaceae*, *Tremellaceae*, *Auriculariaceae*, *Corticiaceae*, *Hydnaceae*, *Meruliaceae*, *Polyporaceae*, *Cyphellaceae* and *Fistulinaceae*, collected in the Tokyo University Forest in Chiba Pref.

Up to the present time, these fungi are of 100 species belonging to 47 different genera. The fungous flora of this forest appears on the whole to have many southern species. These southern species are as follows.

Dacrymyces San-Augustinii Y. KOBAYASHI, *Tremella samoensis* LLOYD, *Stereum spectabile* KL., *Hymenochaete Sallei* BERK. et CURT., *H. unicolor* BERK. et CURT. *Lopharia mirabilis* (BERK.) PAT., *Trametes Kusanoi* IMAZ., *T. vittata* (BERK.) LLOYD, *Gloeophyllum subferrugineum* BOND. et SING., *Coriolus neaniscus* (BERK.) IMAZ., *Hirschioporus versatilis* (BERK.) IMAZ., *Fomitopsis cinerea* (TORR.) IMAZ., *F. pubertatis* LLOYD, *Microporus flabelliformis* (KL.) PAT., *M. subaffinis* (LLOYD) PAT., *Cyclomyces tabacinus* (MONT.) PAT., *Phellinus hamatus* (GORN.) IMAZ., *Cryptoderma substygium* (BERK. et BR.) IMAZ., *Onnia Cumingii* (BERK.) IMAZ.

In this paper, judging from the descriptions and photographs, the auther reduced *Licentia yao-chanica* PILAT to the synonym of *Lopharia mirabilis* (BERK.) PAT., and *Fomes ajazi* HUSSAIN to *Cryptoderma lonicerinum* (BOND.) IMAZ.

129. On the measurement of decay durability through the boring-test on "Sugi" wood test pieces. Haruyoshi SAHO (Journ. Jap. Forestry Soc. **35**, 359-364, 1953)

In this experiment, to indicate the decay of "Sugi" (*Chryptomeria japonica* D. DON) test pieces, the author used the measurement of decrease in the oven-dry weight and the boring test method. The test pieces were decayed artificially by *Trametes albida* BOUND. et GOLZ. and *Gloeophyllum trabeum* (PERS. et FR.) MURR.

Nearly linear relation between the ratios of decrease in the oven-dry weight and in the specific torque energy for boring was observed. It has turned out possible to judge the decay durability of "Sugi" wood test pieces with the considerable accuracy by the measurement of specific torque energy for boring.

130. Diagnosis of wood rotting fungi by red cabbage extract. Shun-ichi YOKOTA (Journ. Jap. Forestry Soc. **36**, 72-75, 1953)

BAVENDAMM's reaction was used for a long time for diagnosis of wood-rotting fungi. As for the oxidase of fungi, it was clarified in recent studies that there are two types of phenol oxidase, laccase and tyrosinase. Recently, JORGENSEN and VEJLBY proposed a new method for diagnosis of wood-rotting fungi in which red cabbage extract was used in place of chemical reagents used in BAVENDAMM's reaction.

In the oxidase test by using phenolic substances, the writer found that the substantial difference between white and brown rot fungi consists in the presence of laccase in the former and the absence of it in the latter. Further, the author reexamined the method of JORGENSEN et al. and made it clear that the reaction of changing the colour of the extract yellow from purple with white rot fungi coincided well with the existence of laccase and red from purple with brown rot fungi was due to the strong acidity of the medium on which they developed vigorously.

According to the results that the reaction of changing the colour yellow from purple agrees with the existence of laccase which is the characteristic of white rot fungi and that this colour reaction required relatively a short period of time, it seems to be an excellent method for diagnosis of woot rotting fungi.

131. On several factors which affect the conidial characteristics of *Fusarium solani* (MART.) APP. et WR. I. On the concentration of constituents of media, temperature and duration of incubation. Shun-ichi YOKOTA (Bull. Tokyo Univ. Forest **45**, 155-164, 1953)

It is well known that the morphological characteristics in the genus *Fusarium* varies widely corresponding to the change of environmental conditions. The writer examined the variation of conidial characteristics of this fungus in accordance with the change of cultural conditions, such as the concentration of carbon- and nitrogen-source, the temperature and the period of incubation.

The conidial size tended to become small with the increase of the concentration of glucose, and 3-septate conidia ceased to be formed at 5% of glucose in the medium. In general, the cell content is granular, but granules gave place to oil drops at higher concentration of glucose (10%). 3-septate conidia ceased to be formed when the concentration of asparagine reached 0.5%. Definite tendency of variation in the size and of the shape of conidia could not be recognized. As for the temperature in incubation, it was recognized that the size of conidia tended rather to increase in accordance with the rise of it. The influence of the period of incubation upon conidial size and shape was obscure.

132. On several factors which affect the conidial characteristics of *Fusarium solani* (Mart.) App et Wr. II. On the concentration of the medium. Shun-ichi Yokota (Bull. Tokyo Univ. Forest **45**, 165-180, 1953)

This paper dealt with the change of the morphological characteristics, such as the formation of septa and the size and shape of conidia, which appeared corresponding to the change of the concentration of the medium. The concentration of Brown's "synthetic potato dextrose" agar was regarded the the standard which was expressed by N, and then each component was modified so as to have the grade of N/10, N/5, N/2, N, 2N, and 5N, respectively. That of agar was fixed to 2% in each case. *Fusarium solani* grown from mono-sporous origin was cultured on the medium of various concentration at 23°C for 20 days. Conidia were stained by ruthenium red and microscoped. The results are summarized as follows:

(a) The rate of appearance of 3- and 2-septate conidia decreases in accordance with the increase of the concentration in the range of N/10-N/2 and then it begins conversely to be larger from N/2-5N. On the contrary, that of 1-septate conidia shows the reverse tendency to that of 3- and 2-septate conidia.

(b) The tendency regarding to the size of 3- and 1-septate conidia is similar with that in the rate of appearance of 3-septate conidia, namely, a maximum value of the size 3-septate conidia appears at N/10, then decreases and it gives the smallest value at N/2, then increases conversely according to the increase of the concentration of the medium.

(c) According to the results above mentioned, it seems to exist a close relation between the change of the rate of appearance and that of the size of them. The mode of the change of the rate of appearance and of the shape in 3-septate conidia coincides with each other.

133. On the amino acids of coniferous seeds at the germination stage. Ken-ichi Hatano (Bull. Tokyo Univ. Forests **45**, 145-154, 1953)

The free amino acids in the dormant seeds and germinating embryos of *Cryptomeria japonica* and *Pinus densiflora* were studied by extracting the dried materials with 80% ethanol and examining the extract after concentration by two dimensional paper chromatography. At the same time, the protein-constituting amino acids in

these seeds were studied by hydrolysing the ethanol insoluble fractions with 25% HCl and examining the hydrolysates by the chromatography. About fifteen amino acids were detected in all cases. In these results, it is remarkable that asparagine appeared, only when the seeds germinated. An unknown ninhydrin sensitive substance, which was found above valine on the chromatogram, existed in the seeds and the germinating embryos in the free state. Being different from the case of *Cryptomeria* seeds, the ethanol soluble fraction in *Pinus* seeds was inseparable by the paper chromatography. When this sample was hydrolysed with 20% HCl, the amino acids were separated finely, and, above all, glutamic acid and proline were detected evidently in this hydrolysate. With the progress of germination, the free amino acids increased, and those in the alcohol insoluble residues decreased. The relation of free amino amino acids to the progress of germination was tested quantitatively by an application of ninhydrin reaction's sensibility. At last, the scheme of amino acids formation at the germination stage was discussed.

134. On the amino acids in the seeds of *Pinus Thunbergii* at the germination stage. Takahide KANÔ and Ken-ichi HATANO (Journ. Jap. Forestry Soc. **35**, 292-298, 1953)

The amino acids in the dormant and germinating seeds of *Pinus Thunbergii* were examined by two dimensional paper chromatography. As a whole, 16 amino acids, 1 amide and 6 unknown substances were isolated. The free amino acids in the seeds were poor in quantity, but those increased evidently with the progress of germination. Especially, it was noteworthy that asparagine appeared when the seeds germinated, and an unknown substance was detected above valine on the chromatograms of all the methanol extracts. The nitrogenous compounds of dormant seeds were divided into three fractions, i.e. (1) the methanol soluble fraction, (2) the KOH soluble and (3) the KOH insoluble fraction. In the seedlings, the KOH soluble fraction was absent.

135. On the amino acids in the seeds of *Carya Pecan*. Ken-ichi HATANO (Trans. 63rd Meet. Jap. For. Soc. 84-86, 1954)

The amino acids in the seeds of *Carya Pecan* were analysed by the technique of paper partition chromatography. The free amino acids were extracted with 80 per cent ethyl alcohol, and the crude protein extracted with 0.2 per cent caustic pottash and precipitated with dilute acetic acid.

In the alcohol extract, there were glycine, α-alanine, valine, leucines, serine, cystine, ϕ-alanine, aspartic acid, glutamic acid and one unknown ninhydrin sensitive substance. And there were found in the hydrolysate of crude protein, glycine, α-alanine, tyrosine, lysine, histidine(?), arginine, proline, aspartic acid and glutamic acid.

136. The effect of drying of soil on apparent photosynthesis, transpiration, carbohydrate reserves and growth of seedlings of Akamatsu (*Pinus densiflora* SIEB. et ZUCC.). Ken'itiroo NEGISI and Taisitiroo SATOO (Journ. Jap. Forestry Soc. **36**, 66-71, 1954)

The influences of drying down of soil on the apparent photosynthesis, transpiration, amount of carbohydrate reserves and growth were studied with 1-year-old

seedlings of Akamatsu (*Pinus densiflora* SIEB. et ZUCC.) under the field conditions. The test seedlings received the treatment of gradually drying of soil for once or twice in the summer of 1952, meanwhile the soil moisture in the pots of control seedlings were held nearly at the field capacity.

It is evident that deficient amount of soil moisture resulted in subnormal rates of apparent photosynthesis and transpiration, but the degree of depression of the rates depended not only upon the soil moisture but also the air humidity. When water was applied to the soil in which test seedlings were grown, the apparent photosynthesis and transpiration of tests recovered to their original relationship with the controls in next day after the watering. A slight increase in apparent photosynthesis was observed with a little decrease in soil moisture below the field capacity.

The percentage of carbohydrate reserves was slightly higher in test seedlings in comparison with controls just after the treatment, but these differences diminished in early spring of 1953. The rate of diameter growth of tests was markedly depressed during the period of drying down of soil, on the contrary, after the treatment the rate was higher in test seedlings.

Although a marked reduction in the production of carbohydrate occurred under the drought conditions, the percentage of it was higher in tests, and it is supposed that this higher percentage is due to decreased consumption of carbohydrate reserves for growth, because the rate of growth was depressed remarkably during the period of drying of soil.

The effect on the growth in next year 1953 was not obvious.

137. **Influence of soil moisture on photosynthesis and respiration of seedlings of Akamatsu (*Pinus densiflora* SIEB. et ZUCC.) and Sugi (*Cryptomeria japonica* D. DON.).** Ken'itiroo NEGISI and Taisitiroo SATOO (Journn. Jap. Forestry **36**, 113-117, 1954)

The effects of decreasing of soil moisture and light intensity on apparent photosynthesis and respiration were studied with 1-year-old, pot grown seedlings of Akamatsu and Sugi under controlled conditions.

Experiments were performed in an insulated chamber where light intensity was held constant at 45,000 lux. on the upper surface of shoot chamber (experiment 1) or at levels of 75,000, 45,000, 15,000, 7,500 lux. (experiment 2) and temperature was held nearly at 30°C, relative humidity at about 65 per cent.

The data of experiment 1 show that highly significant difference was observed between the species concerning the influence of soil moisture on apparent photosynthesis; for Sugi an increase in apparent photosynthesis was associated with some decrease in soil moisture below the field capacity, and then marked reduction occurred, for Akamatsu on the other hand, a reduction happened immediately with a slight decrease below the field capacity, but the rate of depression was less prompt in comparison with Sugi. The relationship between the respiration and the soil moisture was not obvious.

From the result of experiment 2, it is evident that the higher the level of light intensity takes place, the more the effects of decreasing of soil moisture can be observed.

138. Germination of *Cryptomeria* seeds from cones which remained green on the tree for two years. Taisitiroo SATOO, Masasi GOO and Sato HASEGAWA (Journ. Jap. Forestry Soc. **36**, 53-54, 1954)

The authors found a tree of *Cryptomeria japonica* which retains their cones still green in the spring, and made germination test of seeds in them. Cones which ripened in the autumn of 1950 were still green in the spring of 1953 when test was discontinued. Water content of cones and germiability of seeds showed minimum change through two years, as far as they stay on the tree. Germination per cent fluctuated with individual cones, but it was not affected by cone's bearing on the tree.

139. Does the quality of seed change yearly? An experiment employing seeds from the same mother tree of *Cryptomeria japonica.* Kentaro NAKAMURA, Masasi GOO and Sato HASEGAWA (Journ. Jap. Forestry Soc. **36**, 1-2, 1954)

The production, volume, weight and germination of seeds from the same trees of *Cryptomeria japonica* were investigated for succeeding several years. The volume and weight of seeds from the same tree the period did not depend upon full or fair seed production. In case of poor seed production, however, sufficient enough to determine them were not obtained. The germination per cent from the same tree during the six was free from seed production.

140. Is germination per cent of Sugi (*Cryptomerica japonica*) seeds affected by the position in the crown of their cones? Masasi GOO (Journ. Jap. Forestry Soc. **36**, 24-26, 1954)

Seeds were collected from various height and direction in the crown of *Cryptomeria* trees and their germination per cent was determined. No significant difference due to height and direction was found.

141. Seed germination as affected by suction force of soil and saccharose solution. Taisitiroo SATOO and Masasi GOO (Bull. Tokyo Univ. Forests **46**, 159-168, 1954)

Germination of seeds of conifers in deficient soil moisture conditions was studied with special reference to specific difference.

(1) Seeds of *Cryptomeria japonica, Chamaecyparis obtusa,* and *Pinus densiflora* were shown in three different treatments: sufficiently watered, mulched, and no treatment. Watering increased number of germinated seeds of *Cr. japonica* and *Ch. obtusa,* but mulching gave the same effects only to seeds of *Cr. japonica*: whereas germination of seeds of *P. densiflora* was not influenced by any of these treatments. From these results the rank order of sensibility of seeds to soil moisture deficiency came out as *Cr. japonica* > *Ch. obtusa* > *P. densiflora.*

(2) The findings in the above mentioned observation were ascertained by following experiments with controlled conditions. Seeds of *Ch. obtusa, P. densiflora* and *P. Thunbergii* were sown in containers filled with nursery soil of different soil moisture content. Seeds of all three species germinated sufficiently when the moisture content of the soil reached 50% (ca. 8 atm. in soil moisture tension) or more, but below it germination adversely declined with decreasing soil moisture and the decrease was more phenomenal in *Ch. obtusa.*

(3) Suction force of seeds, which was determined with BUCHINGER's method, was as follows: *Cr. japonica* and *Ch. obtusa*, 0.35 mol., *P. densiflora* : 0.40 mol., and

P. Thunbergii 0.45 mol. This rank order represents the results of experiments above mentioned. Germination decreased abruptly beyond certain concentrations differing with species. The concentration was observed as: *Cr. japonica* and *P. densiflora*: 0.25 mol., *Ch. obtusa*: 0.30 mol., and *P. Thunbergii*: 0.40 mol..

(4) The amount of water absorbed from saccharose solutions of various concentrations by seeds of *Cr. japonica, Ch. obtusa, P. densiflora* and *P. Thunbergii* was determined by weighing individual seeds. Seeds of all species could not absorb enough water to cause germination from the solution of more than 0.75 mol. in concentration. In these cases, when seeds absorbed a certain amount of water corresponding to the concentration of the solution, no more water would came in.

142. Drought resistance of seedlings of *Cryptomeria japonica, Chamaecyparis obtusa,* and *Pinus densiflora.* Taisitiroo SATOO (Gizitu Kenkyuu (Tokyo Regional Forestry Office) **4**, 41-45, 1953)

Species difference in drought resistance of the seedlings of the three conifers in the first summer is discussed.

143. Forest nursery and water. Taisitiroo SATOO (Ringyoo Kaisetu Series 57 pp. 34, 1953)

Problems in forest three seedlings and soil water relationships are reviewed.

144. An attempt to measure the daylight-factor under crown canopy with the solid angle projecting camera. Tadayoshi SUZUKI and Taisitiroo SATOO (Bull. Tokyo Univ. Forests **46**, 169-179, with Pl. I-IV, 1954)

An attempt was made to apply the solid angle projecting camera, which has been used in the architectural science, to the measurement of openings in the crown canopy. After describing the outline of the structure and the accuracy of the camera, the results of measurements in thinning plots are given in terms of daylight-factor and the time length of the exposure to direct sunlight on various daytime and in various seasons. The accuracy and the extent of its applicability are discussed.

145. Water relations of cuttings shortly after planting. Taisitiroo SATOO and Narakatu HUKUHARA (Bull. Tokyo Univ. Forests **45**, 89-101, 1953)

Leaf-bundle cuttings of *Pinus densiflora*, and stem cuttings of *Cryptomeria japonica* and *Evonymus japonicus* showed extremely high transpiration rate on the next day of planting, as compared with needles on seedlings and rooted cutting used as controls, then decreased gradually until it got to some stabilized values lower than the controls. These "stabilized" values were reached about one week after planting, on all species used. Daily march of transpiration of newly planted cuttings of *E. japonicus* was extremely different from rooted ones during the first several days following planting. The transpiration rate of the former was very high in the morning and abruptly it decreased in the afternoon; whereas the rate of rooted cuttings showed the daily march of the usual type. After about one week, newly planted cuttings showed similar daily march to the rooted ones, but their rates were significantly lower than the latter. Daily march of the change in aperture of stomata of cuttings of *E. japonicus* showed similar trend to transpiration. From these findings the writers suggest that special cares should be paid to the protection of cuttings during the first week following planting, in the practice of vegetative propagation.

146. Origin and development of adventitious roots in *Thujopsis* cuttings. Seizaemon SATOO (Journ. Jap Forestry Soc. **35**, 220-225, 1953)

Origin and development of adventitious roots in cuttings of *Thujopsis dolabrata* were observed. Roots arose from stem tissues near the cut base and from callus tissues. Most of roots from stem tissues initiated in the cells of phloem region of primary ray tissues immediately below the leaf trace, developing in rather elongated shape as compared with *Cryptomeria* cuttings formerly observed, and the others arose in connection with leaf traces. Roots from callus tissues developed as a group of meristematic cells in connection with the differentiating callus xylem. Only one root seemed to arise from the parenchymatous phloem layers, connecting with newly formed xylem near the cut base. Distribution of root primordia and roots from 10th to 64th day after planting are shown.

147. Concerning the ski lift. Tadayoshi SUZUKI (National Parks Magazine 48, 8-11, 1953)

The ski is growing in popularity in Japan. The ski lift is one of new facility in ski area, also in our country. The author investigated the ski lifts in foreign and our country, and reported as to the following.

1. Relations between ski lift and ski area.
2. Types of ski lift and their characteristics.
3. Selection and location of ski lift.

148. Camp Site Development. Satoshi SHIOTA (Japan Federation of Tourist Association, Tokyo pp. 110, 1953)

Reported on the planning of recreation and education camp in Japan, as one of the Tourist Industrial Engineering Series of J.F.T.A.

Part 1 Camping and Camp Site in Japan: It is necessary that we should consider many factors concerning camp site itself, and is the first problem to improve upon the imperfect inner side of our camping that seems prosperous from outside. As the factors and problems that should be considered on the planning of new camp site, the forms of the utilization and the living environments which contain the problems of landscape, vegetation and accident are taken up.

Part 2 Master Plan of Camp Site: The planning of camping area contains the master plan and the design of its facilities, the master plan is the development of whole camping area. Topographical map for planning, projection and planning of water supply, road, electricity, sewage, waste disposal and landscaping are taken up. The method for planning standard of these is the aim of this chapter.

Part 3 Facilities of Camping Area: The facilities concerning to require for camp life with their standard for design, are written. The main contents are the facilities of educational or recreational camp, for example tent, cabin, lodge, water supply, privies, fireplace, sign, campfire circle and outdoor theater.

Part 4 Future of Camp Site in Japan: Present character of Japanese camping and its site and the examples of foreign camping bring into the future existence of Japanese camp. As the conclusion, it is necessary that we should rise to the level of camping and camping area, concerning the camp site projection, camp facilities, camp utilization and camp management in Japan. The aim of this chapter is these methods.

149. Comparison of the growth of *Cryptomeria japonica* and *Chamaecyparis obtusa* planted in alternate rows. (3). Masao YOSHIDA and Taneo HIRATA (Bull. Tokyo Univ. Forests **45**, 1-65, 1953)

Following are the results obtained from research on the growth or stand-composition of Sugi (*Cryptomeria japonica*) and Hinoki (*Chamaecyparis obtusa*) planted in alternate rows, conducted in 1942 at the Tokyo Univ. Forest in Chiba Prefecture.

(1) The periodic growth of Hinoki during recent 7 years (Aug. 1935-Aug. 1942) is much larger than that during the preceeding 7 years (Aug. 1928-Aug. 1935), but, as compared with results of 1935, it is constant in height and smaller in DBH, basal area and stem volume; therefore it is difficult to say that the recent relative growth of Hinoki is as good as that during 1928-1935. However, on a site of lower class, the increment of Hinoki is as much larger than that of Sugi as was observed in 1935, in other words, Hinoki is more independent of the site class than Sugi; this is also proved by the fact that the standard deviations of Hinoki are always smaller than those of Sugi as regards the main factors. From these statistical results, therefore, it can be expected that a mixed stand of Sugi and Hinoki or a pure stand of the latter is profitable on a site of lower class. Neverthless, it must be remembered that our observation on the competition of Hinoki with Sugi is neglected.

(2) The relative value of branch volume (crown length/stem height and crown breadth/DBH) is larger than that of Sugi. However the absolute values of crown length and breadth of Hinoki are not always larger than those of Sugi. This means that the tapering of Hinoki has rather approached to that of Sugi.

(3) The growth of Hinoki is comparatively better as shown in the table below.

Percentage of Dominant.

Year \ Species	Hinoki	Sugi
1935	83 %	85 %
1942	87 %	79 %

150. Fundamental studies on the formation of cutting series (2) On the centre pressure, drag coefficient of a tree and one effect of shelter belts. Taneo HIRATA (Bull. Tokyo Univ. Forests **45**, 62-87, 1953)

Followings are the results of observation in the wind tunnel experiment, employing.

(A) 3 models of crown, made of both a wirework frame which forms just a cone, and some leaves of *Cryptomeria japonica*, or

(B) 3 seedlings of *Picea Glehnii Mast.* and *Thuja orientaria L.* about 0.75 m. high in average.

(1) The coefficient of centre pressure (Cp) is 1/3 in the case of (A) and less than $(1/3)(1 + b/\overline{a+b})$ in the case of (B). The former is the case when the drag to stem is neglible, for instance, of a tree within a stand or at the edge with artificial shelter belt, and the latter is the case without the belt, when the drag to stem is not negligible. It can be approximately said that there is little difference between the mean in values observed and the values calculated (on the assumption that the ratio of drag coefficient of the stem and the crown is equal to 1, the wind is laminar and

bodies are rigid, in the case of (B). Drag coefficietn observed in them, however, cannot always be reliable.

(2) In the limit velocities, that is, the lower limit of wind velocities enough to break a stem or blow down a tree (not a stand), so far as m (clear length/height) ranges from 0 to 1/2, both cases are nearly same; at the range of m more than 1/2, the case (B) is generally in the more tapering tree, the more larger than the case (A) in the limit velocities to stembreak. To blowdown, the case (B) is slightly small. The tree with a smaller crown in breadth is more resistable against stembreak than a arger; no simple conclusion can be reached here against blowdown.

(3) Therefore it is probably referred to the practice of forestry that the artificial shelter belt (Kunsttrauf), if limited here merely in the sense of protecting edge trees just behind the one, is

i. against blowdown significant at their range of m more than 1/2,

ii. against stembreak never significant at the same range of m as above, and

iii. at their (opposite) range of m less than 1/2, significant for protecting against rather prevailing than stormy wind, because the limit wind velocities show hardly different values, but their independency on the presence of the artificial shelter belt; of course the natural shelter belt (Naturtrauf), of which m needs to be kept near upon 0, is much more effective and therefore necessary.

These notices are grounded on the fact that storm damages within stands are often started from the destroyed parts of edges of stands.

151. Comparison of the growth of *Cryptomeria japonica* and *Chamaecyparis obtusa* planted in alternate rows. (4). Masao YOSHIDA and Taneo HIRATA (Bull. Tokyo Univ. Forests **46**, 97-114, 1954)

The authors reported 3 times in the Bull. Tokyo Univ. Forests on the comparison of the growth or stand composition of Sugi (*Cryptomeria japonica*) and Hinoki (*Chamaecyparis obtusa*) planted in alternate rows parpendicular to contour lines at Tokyo Univ. Forest in Chiba Prefecture.

(1) on the research in 1928, No. 11.
(2) „ 1935, No. 28.
(3) „ 1942, No. 45.

Following are the results obtained from our recent (the 4th) research on the same subject in 1951, concerning mainly the average diameter and basal area.

A. Comparison on the whole forest.

(1) In the percentage of stem number, Sugi is 54% and Hinoki 46%; both values are as large as in 1942.

(2) In the ratio of decreased stem number at the present to the total in 1942, Sugi is 0.21 and the Hinoki 0.16. These are both larger than in 1942.

(3) In the average diameter Hinoki is 0.88 of Sugi, and in the increment the former is 0.81 of the latter. These are rather smaller than in 1942.

(4) In the average diameter or basal area Hinoki is smaller on the site of upper class, but on lower class it is larger than Sugi; this is the same result as obtained in 1942.

(5) In the average basal area Hinoki is 0.75 of Sugi, relatively smaller than in 1942.

(6) The skewness in their distributions looks like more positive, compared with that in 1942, but not so remarkably.

(7) In the standard deviation, Hinoki is smaller, as it was in 1942, than Sugi.

B. Comparison on sample belt.

(1) In the ratio of decreased number at the present to the total in 1942, Sugi is 10%, and Hinoki 9% on plots totaled.

(2) In the average diameter the former is 0.87 of the latter on plots totaled, relatively smaller than in 1942.

(3) In the height of sample tree Hinoki is 0.90 of Sugi, relatively as large as in 1942.

(4) In the average basal area of the sample tree Hinoki is 0.75 of Sugi relatively smaller in 1942.

(5) In the skewness Hinoki is almost negative, and a half of those plots of Sugi is also negative.

Following are the results checked over the above 3 reports, just as mainly the average diameter and basal area concern.

(1) The average diameter and standard deviation get large with their age and the coefficient of variation rather independent of age.

(2) On the whole of the forest, or on sites of upper classes Hinoki is smaller than Sugi in its average, standard deviation and C.V. of diameter and basal area.

(3) On sites of lower classes Hinoki is as large as or larger than Sugi in the average diameter.

(4) The standard deviation of diameter of Hinoki is generally smaller or more independent of a site class, on which it stands.

(5) Skewness in the diameter distribution of the both species shows no positive tendency in the relation to the age of a stand.

(6) If only the distribution of diameter shows a normal type, the C.V. of basal area, which accordingly forms one of non central chi-square distributions, is larger than that of diameter.

(7) The ratio of Hinoki to Sugi in standard deviation of diameter is larger than that of basal area and in C.V. of the former is smaller than that of the latter.

152. On the reliability of the theory of the *Parabolic Cable* applied for the calculation of the skyline logging cables. Seihei KATO (Trans. 62nd Meeting, Jap. Forestry Soc., 183-185, 1953)

The author proved the reliability of the theory of the *Parabolic Cable* as compared with the theory of the *Catenary* when they are applied for the calculation of the skyline logging cables. The calculated values of the sag of the cable, the locus of the applied vertical load (single concentrated load), the tension of the cable, etc., which are all derived from the theoretical formulae, are fairly coincident with the empirical values, provided that the boundary conditions for the cable are strictly adapted to the theoretical assumptions. The theoretical formulae are based on the assumptions, that, (1) the cable is perfectly flexible, (2) the cable is fixed at both ends and there occurs no displacement of the supporting points, and (3) there is no change in the length of the cable at any time. The author found that these assumptions are no longer true for the cases of the real logging main cables which are

usually placed under high tension with small sag-ratio and large load-ratio. Therefore, the effects of the displacements of the supporting points due to the carriage lead, of the change in the cable length due to the temperature change, and of the elastic elongation of the cable due to the tension increasing when the carriage load is applied, must be taken into account. Then, the ordinary formulas of the *Parabolic Cable* should be somewhat modified for this sake. Thus, the new theoretical formulae, which are to be applied for the modification of the ordinary formulae, were derived by the author, and the sufficient reliability of the new formulae were also proved by the various experiments performed by him.

153. On the resistance of the forest-railway trolleys. Makoto FUJIBAYASHI and Seihei KATO (Trans. 62nd Meeting, Jap. Forestry Soc., 185-186, 1953)

To investigate the character and the amount of the trolley resistance on the forest-railway tracks, the authors performed various field experiments in the Tokyo University Forests at Chichibu and in Hokkaido. The explanation of the methods of the experiments, the numerical results, and discussion about them are reported in this paper. The authors found that the value of the coefficient of curve-resistance is proportional to the "*Curve-factor*" of the track-line, which was denominated by them.

154. An all-season tractor-truck, designed and tested. Makoto FUJIBAYASHI, Seihei KATO, Masakazu MARUYAMA and Masato HAYASHI (Trans. 62nd Meeting, Jap. Forestry Soc., 189-190, 1953)

A unique *Tractor-truck* was designed to be able to run along the snowy countryside in winter and which also be able to serve as an ordinary truck in summer. A 3-wheeled smallsize commercial truck (with 40 HP, 4-cycle, 2-cylinders, water-cooling gasoline engine) was chosen as the base, the front wheel of which was replaced by the steering steel sledge while the rear axle and wheels were replaced by the special driving devices and the caterpillar runners. The last improved machine was completed and the field test was carried out in a snow field in Furukawa National Forest, Gifu prefecture, in March, 1953. The principles of the design, the elements of the machine, and the results of the test are reported in this paper.

155. Studies on weight-growth of forest trees. IV. *Cryptomeria japonica* D. DON of the Tokyo University Forest in Chiba. Shinji HIRAI (Bull. Tokyo Univ. Forests **45**, 203-221, 1953)

Seven sample trees of *Cryptomeria japonica* D. DON (Sugi) of 52 years of age were taken from an artificial stand in the Tokyo University Forest in Chiba. The distribution of the bulk density of wood, "Raumdichtezahl" by R. TRENDELENBURG, within the stem of each sample was examined, and from this result the weight increments of individuals and the weight produce of the stand were calculated. Following results were obtained.

(1) There are left- and right-inclined types in the frequency curve of the bulk density of an individual. The total curve indicates a slightly right-inclined type. The degree of deviation is slightly low compared to that of the previously reported one of the same species.

(2) The distribution map of the bulk density is considerably complicated, differ-

ing with the individuals, but the following general tendencies are found. The wood is generally heavy through the center of tree, but in some instances there exists somewhat lighter area under 1/2-1/3 of tree height compared to the base and the top, and the heavy wood at the top occupies the whole area. Extremely light wood is formed in the portion over 25-35 years of age at the tree base, but the outest part is slightly heavier. When the volume growth is inferior, the heavy wood portion of the tree top apts to extend downward along the outest side.

(3) There is no correlation of 1st degree between the ring-width and the bulb density of wood.

(4) The weight-increments of the trees are mostly affected by their volume ones, but two samples have not yet attained to the maximum of the current annual increment of weight at the age of 52 years, though they already have displayed the maximum of volume one at the age of 45 years.

(5) The standard bulk densities of the individuals, which are obtained by dividing the total weight-increment by the volume one, are 292-398 kg/m^3, and the mean is 338 kg/m^3. There is a tendency that the more inferior the tree is, the heavier the wood is, but the tree which indicates the best volume growth does not have the lightest wood.

(6) The total production per 1 ha of this researched stand amounts to 171,134 kg in weight and 518.50 m^3 in volume, and the average annual production 3,291 kg in weight, 9.97 m^3 in volume. These values are fairly large according to the more stem number of the stand, compared to the previously reported one of Ibaragi Pref.

156. Studies on laminated wood with sawn boards. II. On the adhesive strength of joints at defects in a laminated wood of *Cryptomeria japonica* D. Don. Shinji Hirai and Hisashi Fukui (Bull. Tokyo Univ. Forests **45**, 223-235, 1953)

The authors compared the strength of joint at defect within clear wood in a full sized laminated wood of sugi lumbers (*Cryptomeria japonica* D. Don), which are abound in knot, decay and cross grain, and are 1,800 mm in length, 100 mm in width and 25 mm in thickness.

Assembling conditions:

Numbers of lamination 7
Surfaces of lumbers .... Machined with surface planer
Water content of lumbers at the time of assembling 15.6%
Adhesives .....Room-temperature-setting area resin adhesives containing filler, 5% to resin
Glue spread .... 330 g/m^2
Assembling pressure .... 5 kg/cm^2
Curing time .... 48 hours

(1) Decay

The grade of decay in this experiment is in primary stage (discolor, no decrease of specific gravity), and all the tested glue joints are those between decay and clear wood. There is no difference of adhesive strength and wood failure between glue joint at decay and that in clear wood. So that in some cases only from the point of view of adhesive strength the use of sugi lumber containing decay of primary grade as in this experiment may be sanctioned in the preparation of laminated wood.

(2) Cross grain

All the tested glue joints are those between the defect and clear wood (straight grain). Only about the results of this test, the difference of adhesive strength between the glue joint at cross grain and that at straight grain is not significant, but in consideration of the results of our other experiments it is reasonable that the adhesive strength of joint at the former may be substantially weaker than that at the later. Value of wood failure is also lower at cross grain.

(3) Knot

In dry test the adhesive strength at knot is lower than that in clear wood (significant within 2.5% level). As one of the causes of this fact, it is thought that the knot part is one of the sorts of cross grain ($\theta \fallingdotseq 90$). But in water immersion test there is no difference between them. In addition, as a particular case, the glue joint at adjacent area of knot was tested. The adhesive strength at this part, too, was evidently lower than that in clear wood (significant within 2% level).

As to the wood failure there is same tendency as adhesive strength.

157. A study on the cutting of hard fiber-board. (I) On the sawing by circular saw. Kakuichi KITAHARA and Ryoichi SAKURAI (Trans. 62nd Meeting, Jap. Forestry Soc. 244-245, 1953)

The authors studied the cutting of fiber-board by circular saw, rip, cross-cut and intermediate.

The hard fiber-board, used in this experiment was made of ground pulp and resin soap. Its moisture content was 11%. The specific gravity was 0.90 in air dry and 0.81 in oven dry.

BRINELL hardness was 2.70 kg/mm. The diameter of saw was 10 inches and their conditions were showed in the following table.

Kind	Thickness (mm)	Set (mm)	Number of teeth	Hook angle	Tool angle	Clearance angle
Cross-cut	1.15	1.60	110	21°	43°	69°
Intermediate	1.14	1.55	110	14°	42°	34°
Rip	1.24	1.74	100	28°	42°	20°

The results obtained were as follows:

(1) The relation of saw blade height above table and maximum power, keeping the velocity of feeding speed constant is shown by minimum curve and cross-cut and intermediate saw are superior.

(2) The relation of feeding speed and maximum power, keeping the height above table constant is indicated by almost linear formula, and cross-cut and intermediate saws are superior.

(3) The relations of abration of set and teeth height and maximum power are indicated by next formulae.

$$P = 124 + 5564\,X^2$$

$$P = 86 + 1514\,X^{0.99} \qquad (P = 68 + 1637\,X)$$

where P (Watt) is the maximum power, x (mm) is the abration of set and X (mm) is that of teeth height.

157. On the mechanical properties of bended wood by THONET'S method. Yoshio SAITO and Kakuichi KITAHARA (Wood Industry 8, 501-504, 1953)
by THONET's method.
by THONETT's method.

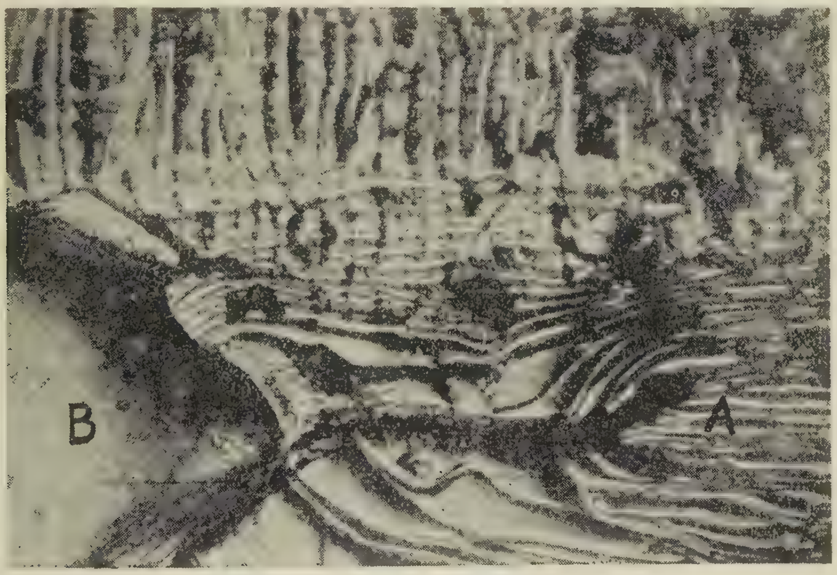
The diameters of the bended wood were 25.5 cm and 35.3 cm and the cross section was 4 × 4 cm. The species was BUNA, *Fagus crenata* BLUME.

The results obtained were as follows:

When wood is bended at small radius, the average values of compressive strength in outer, middle and inner side are the same as that of virgin wood, but the standard deviation is larger in inner side, having large compressive shrinkage. But when wood is bended at large radius the average values are smaller than that of virgin wood at every part in cross section. The standard deviations of outer and middle side are the same as that of virgin wood, but it is larger than those at inner side.

The average values of shearing strength are smaller in outer and inner side than that of virgin wood, but the standard deviations are larger than that of virgin wood.

A typical photograph of bended wood by wood anatomy is shown in the Figure. 'A' is ray and 'B' is collapsed gap.



159. On the effect of pressure at first stage of pressing cycle on the properties of hard chip-board. Kakuichi KITAHARA (Wood Industry 8, 543-545, 1953)

When hard fiber-board and chip-board are made by wet and dry process, the pressure at first stage of pressing cycle is one of the most important factors, deciding the physical and mechanical properties of the board. The author exercised this experiment to decide empirically the effect of this pressure on them.

The pressure at first stage were 5, 20, 40 and 60 kg/cm^2, and was 5 kg/cm^2 at second stage, then 40 kg/cm^2 at last stage.

The results obtained were as follows:

The pressure at first stage of pressing cycle should be large, and the fiber and chip should be pressed sufficiently before the moisture content of them decreases too much.

For instance modulus of rupture and YOUNG's modulus in bending are shown in the table below.

Pressure at first stage (kg/cm²)	Modulus of rupture (kg/cm²)	YOUNG's modulus (kg/cm²)
5	25	4,300
20	88	12,100
40	113	16,400
60	189	19,200

160. Elastic and plastic strains in dried lumber. Yasushi SUZUKI (Trans. 62nd Meeting Jap. Forestry Soc., 217-219, 1953)

Strain distributions in beech board and their changes with the progress of drying were studied. Dimensional change from green condition of any part of board in drying process was considered to be resultant of s, ε_e, ε_e' and ε_p. When drying or dried board is split into thin layers along its width direction, each layer shows instant dimensional change ε_e and following gradual one ε_e' without any moisture change being released from elastic stress. Pure shrinkage caused by decrease of bound water in cell wall s and plastic strain ε_p both of which remain in stress-free layer can be removed by reswelling and heat treatment. Then ε_p was derived deducting s and some amount of over-swelling Δs from total recovered dimension by wet heating.

Some of the test results are shown in Tables 1-2. In these tables, y is the distance from a surface of board expressed by ratio to board thickness (about 35 mm), u the average moisture content of board (%) and strains are given in % of initial dimension (green).

Table 1. Strain distribution in dried lumber.

(a) Air seasoned board.

Sample / y	No. 10			No. 20		
	ε_e	ε_e'	ε_p	ε_e	ε_e'	ε_p
0.05	0.03	0.07	−1.6	0.19	0.07	−0.95
0.2	0.00	0.00	−0.6	−0.04	−0.05	−0.3
0.3	−0.03	−0.02	0.1	−0.04	−0.17	0.1
0.5	−0.03	−0.03	0.5			0.0
0.7	−0.03	−0.06	0.3	−0.09	−0.20	−0.2
0.8	−0.01	−0.02	−0.15	−0.02	−0.08	−0.3
0.95	0.03	0.08	−1.1	0.16	0.11	−1.1
Ave.			−0.2			−0.3

(b) Kiln dried board.

Sample / y	No. 61 ε_e	No. 61 ε_e'	No. 61 ε_p	No. 41 ε_e	No. 41 ε_e'	No. 41 ε_p
0.05	0.24	0.11	1.65	0.19	0.11	1.55
0.2	0.01	0.00	1.8	0.05	0.02	1.8
0.3	−0.12	−0.04	2.1	−0.12	0.00	2.15
0.5	−0.18	−0.06	2.3	−0.17	−0.05	2.1
0.7	−0.16	−0.08	2.0	−0.10	−0.02	2.1
0.8	−0.02	−0.02	1.9	0.04	0.01	1.7
0.95	0.22	0.10	1.05	0.29	0.05	1.3
Ave.			1.9			1.85

Table 2. Strain distribution in kiln-drying lumber.

u% / y	ε_p % 36	18	14	8.5
0.05	−0.3	−0.2	1.0	1.55
0.2	0.3	1.1	1.95	1.8
0.3	0.25	2.15	3.0	2.15
0.5	0.45	2.25	3.3	2.1
0.7	0.2	2.1	2.95	2.1
0.8	0.35	0.95	1.85	1.7
0.95	−0.15	−0.3	0.8	1.3
Ave.	0.25	1.3	2.3	1.85

It can be concluded from these results that apparent shrinkage of beech board is much affected by growth of plastic strain amount of which tends to increase as the drying temperature is held higher, and elastic strain is also intenser in kiln dried board than that in air seasoned one.

161. Studies on bamboo. X. Diffusion of moisture in bamboo. Yasushi SUZUKI (Bull. Tokyo Univ. Forests 46, 211-223, 1954)

Moisture diffusions through bamboo (*Phyllostachys pubescens* MAGEL) and some species of wood of relatively low moisture content under ordinary temperature were studied. Test results are given in Table 1-2 and Fig. 1. These data indicated that moisture diffusions through bamboo are considerably slower than those through wood.

Table 1. Diffusion constants for bamboo and wood with the average moisture content of 10%.

Section / Species	Diffusion constant cm²/sec Trans.	Rad.	Tan.	Temp. C°
Bamboo:	$\times 10^{-2}$	$\times 10^{-2}$	$\times 10^{-2}$	
Outer part	2.0	0.16	0.19	12～16
Inner part	4.1	0.29	0.30	7～16
Chamaecyparis sp.	13.9	—	0.64	7～17
Beech	11.2	—	1.18	8～17

Table 2. Specific diffusion constant λ for bamboo and wood with the average moisture content of 10% (ordinary temperature).

Species \ Section	Transverse	Tangential	Radial
Bamboo:			
Outer part	12.5 (6.7)	0.66 (0.63)	0.75 (0.53)
Inner part	16.0 (13.6)	1.00 (1.00)	1.35 (0.95)
Chamaecyparis sp.	45.5 (44.6)	2.41 (2.12)	3.23 (——)
Beech	36.3 (34.6)	3.75 (3.94)	3.07 (——)

The reasons of this tendency can be explained from anatomical structure of parenchyma cell which is fundamental constituent of bamboo.

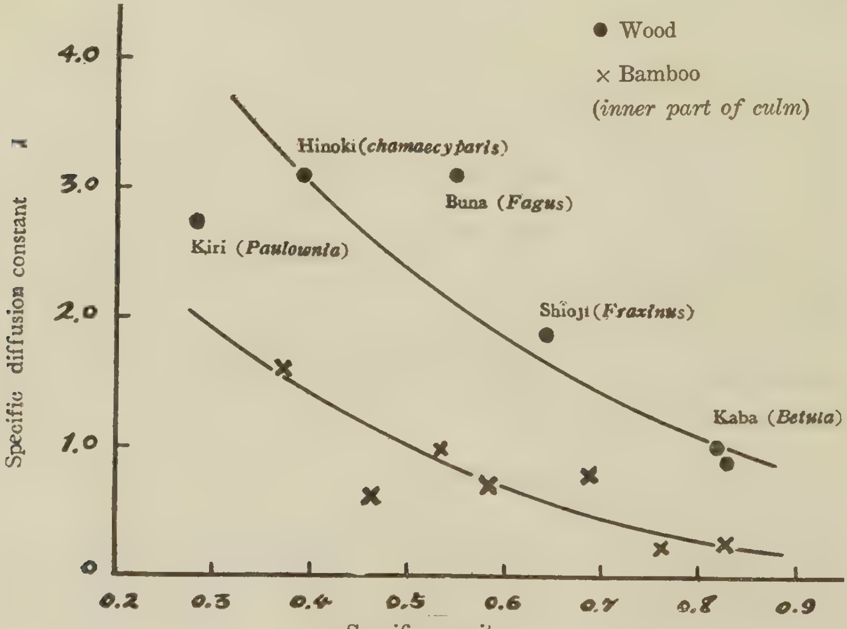


Figure 1.

162. Studies on cut surface. Hisashi FUKUI and Yohji KIKATA (Trans. 62nd Meeting Jap. Forestry Soc. 212-215, 1953)

In the present report, observations of cut and forms of cell-walls on cut surfaces in rectilinear cutting, cutting by planer, sanding, sawing and drilling are described. Maceration process was applied to sections of cut surfaces separated from the test pieces and to chips.

(1) Rectilinear cutting. (Fig. 1)

The end forms of cell-walls are equally flat and in a line.

(2) Cutting by planer. (Fig. 2)

The forms are more uneven than rectilinear cutting.

The cell-walls are partially pressed in a longitudinal direction by impact force of knives about cut end.

(3) Sanding. (Fig. 3)

The cell-walls are of sanded saw-toothed, holey and streaked forms. At sanding across the fiber the cell-wall is cut even.

(4) Sawing. (Fig. 4)

The cell-walls hangnails at the end are extremely uneven in every condition.

(5) Drilling. (Fig. 4)

The forms are similar to those by sawing, but the uneveness is not so extreme and the cut ends of cells are in a line.

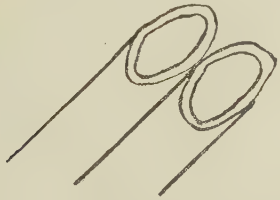


Fig. 1. Rectilinear cutting.

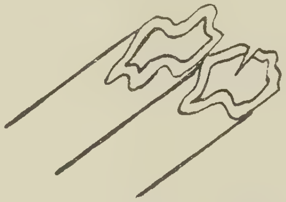


Fig. 2. Cutting by planer.

Fig. 3. Sanding.

Fig. 4. Sawing and drilling.

163. Wood study on *Juniperus virginiana* L. and *Junipirus chinensis* L. Shitomo MAMADA (Bull. Tokyo Univ. Forests 46, 225-231, 1954)

The physical and mechanical properties of wood of "Empitsubyakushin", *Juniperus virginiana* L., from artificial stand in the Tokyo University Forest in Chiba Prefecture were studied by the standard method of testing wood in Japan. At the same time, the results of test on "Byakushin", *Juniperus chinensis* L., were compared with them.

The test results about compressive strength, shearing strength, cleavage strength and hardness are summarized in four tables. The average values of several properties, with reference to the places of growth in Japan and U.S.A., are shown in Table 1.

Roughly speaking, the differences between values obtained by the author and values tested in U.S.A. were not found. The value of American wood in this table were derived from the data of the American Forest Products Laboratory.

Table 1. Comparison of mechanical properties of *Juniperus virginiana* grown in Japan and U.S.A.

Country	Rings /cm	Moisture content %	Specific gravity	Shear strength kg/cm²	Cleavage strength kg/cm²	Cleavage compressive strength kg/cm²
Chiba, Japan	3.0	15.8	0.00	73.7	27.4	433.1
Bennington, U. S. A.	4.7	15.3	0.47	100.4	32.7	424.1

Country	YOUNG'S modulus in compression parallel to the grain kg/cm²	Hardness kg/cm²	
		End	Side
Chiba, Japan	5.18×10^4	5.89	2.73
Bennington, U. S. A.	5.59×10^4	4.1	2.9

164. Studies on carbonization of wood XI. On the source of acetic acid produced in the thermal decomposition of the wood of *Quercus glauca*. Kyoji MINAMI and Kimie KAWAMURA (Journ. Jap. Forestry Soc. **35**, 315-321, 1953)

The intact wood meal of *Quercus glauca*, its wood meal extracted with 1% NaOH, its wood meal free from MeOH-lignin, and its wood meal free from alcohol-benzene extract were subjected to dry distillation. The fact that in the case of the intact wood, much of acetic acid is distilled in the fractions lower than 260°C, was again confirmed by the estimation of the acid in each unit fraction by 20°. Though, in the case of the wood free from alcohol-benzene extract, the total amount of distilled acetic acid was only a little less than that in the case of the intact wood, in both cases of the wood extracted with 1% NaOH and the wood free from MeOH-lignin, it was markedly small. Thus it was inferred that the components of wood removed off with the latter two treatments should be the source of much of acetic acid in the distillate of wood, i.e. acetyl groups which may be hydrolyzed by those treatments.

Further this supposition was confirmed by the observation that the difference of yield of acetic acid between the intact wood and the wood extracted with 1% NaOH was almost equal to the amount of acetic acid found in the extract of wood with 1% NaOH. The fact that on the course of thermal decomposition the maxima of amount of distillate, concentration and amount of acetic acid found in the case of the intact wood were lost in the case of the wood extracted with 1% NaOH also supports the idea.

As for the form of acetyl groups in wood, free acetic acid and salt of acetate were not ascertained, but the ester was the most probable one.

165. Studies on carbonization of wood XIII. On the difference of yield of acetic acid in the thermal decomposition of wood among the kinds of tree. Kyoji MINAMI and Kimie KAWAMURA (Journ. Jap. Forestry Soc. **36**, 136-140, 1954)

Preferring arbitrarily the two kinds of tree, *Mallotus japonicus* as a broad-leaved tree and *Cryptomeria japonica* as a coniferous tree, their intact woods and

residues of wood extracted with 1% NaOH were subjected to dry distillation. For both kinds of tree, in the case of residues extracted with 1% NaOH, the yield of acetic acid remarkably reduced and its difference between the intact wood and the residue was almost corresponding to the amount of acetic acid estimated in the extract of wood with 1% NaOH.

Moreover, as the matter to be emphasized, the residues of three kinds of wood (including that of *Quercus glauca*) extracted with 1% NaOH gave unexpectedly almost equal yields of acetic acid on dry distillation within the limit of error.

On the other hand, the content of pentosan in the residue was markedly diverse among the kinds of tree as well as in the intact wood. Therefore, the theory that the source of distilled acetic acid is pentosans in original wood does not account for the described accordance of yield of acetic acid on dry distillation of residues among the three kinds of tree.

On the course of thermal decomposition of woods and residues treated with 1% NaOH for *Mallotus* and *Cryptomeria* the following facts were observed. As for the change of amount of distillate in an unit fraction by 20°, for *Mallotus*, the peak of curve at 260°C found in the case of the intact wood disappeared in the case of the residue, but, for *Cryptomeria* which gave a lower yield of acetic acid, such a phenomenon was not observed. As for the change of concentration and amount of acids, the highest peaks of concentration and amount of acids existed near 240°C in the case of the intact wood and they disappeared in the case of the residue for both kinds of tree. Further in the case of the residues, the curves of amount of acids in a unit fraction resembled each other among the three kinds of tree and the curves of concentration of acids also show no remarkable difference among the kinds of tree, especially maximum values of concentration of acids were accordantly ca. 10% in total acid and ca. 5% in volatic acid.

These facts point out that the amount of acetyl groups extractable with 1% NaOH in wood plays an important role to bring about the diversity of yield of acetic acid in wood distillation.

166. On the mechanism of color reaction of lignin (III). The mechanism of Mäule color reaction (2). Nobuhiko MIGITA, Junzo NAKANO and Yasuto HASHIMOTO (Bull. Tokyo Univ. Forests **45**, 247, 1953).

(1) Eight kinds of lignin samples were prepared from beech wood; alkali lignin, sulphuric acid lignin, acetic acid lignin, methanol lignin, dioxane lignin, chlorine lignin, phenol lignin and Brauns "native lignin". Among these the methanol lignin gave the most distinct Mäule color reaction. As the Mäule reaction of "native lignin" is faint, this lignin cannot be considered to be representative of protolignin in wood.

(2) Methanol lignin was oxidized with 2% solution of potassium permanganate and then fractionated into three fractions (A, B and D). In the three fractions, only the fraction D is positive in the Mäule test. As the methoxyl content of fraction D is lower than that of others and that of soft wood methanol lignin, the opinion that the Mäule reaction may be attributed to the presence of syringyl nucleus in lignin molecule become doubtful.

167. Studies on lignin (XIX). The sulphonation of vanillyl alcohol, as a model compound of lignin. Nobuhiko MIGITA, Hiroshi MIKAWA, Junzo NAKANO and Motonobu ICHINO (Journ. Jap. Tappi 8, 482, 1954)

The sulphonation of vanillyl alcohol, as a model compound of lignin, at comparatively low temperatures was kinetically investigated. From the results some discussion was made on the mechanism of sulphonation of lignin.

(1) The sulphonation of vanillyl alcohol is very rapid, and the rate of reaction is not practically influenced by the hydrogen ion concentration within a range of pH 2-9.

(2) The sulphoation of vanillyl alcohol approximately obeys the law of a first order reaction, and the velocity constant is about 0.15 (min.) at 90°C. This value is thirty times larger than that of X-group of lignin. The activation energy is 16.5 Cal, and this is approximately equal to that of X-group. The temperature coefficient is about 2.0 per 10 degree. These results indicate that vanillyl alcohol is suitable as a model compound of X-group of lignin.

(3) From the results two types of reaction may be conceivable at the beginning of sulphonation of lignin. One is a formation of benzyl cation by the ionization of lignin, and another is a formation of methylene-quinone type compound from lignin.

168. Studies on lignin (XXI). The condensation product of pinosylvin with vanillyl alcohol, as a model compound of lignin. Nobuhiko MIGITA, Junzo NAKANO, Motononobu ICHINO and Hiroshi MIKAWA (Journ. Jap. Forestry Soc. **35**, 313, 1953)

The condensation product, between vanillyl alcohol and pinosylvin in the acidic sulphite liquor, was isolated, and its chemical structure was examined. Though the condensation product itself was difficult to be purified, the crystals, m.p. 181-182.5°C and 119-120°C, were obtained by acetylation and methylation respectively. From the methoxyl content of the three derivatives, namely the acetylated product, the methylated product and the methylated product of the acetylated one, it may be concluded that the condensation product was formed by dehydration between 1 mol of pinosylvin and 2 mols of vanillyl alcohol. The bahivour of the similar phenolic compounds, suggests that this condensation took place in a para position of each phenolic hydroxyl group of pinosylvin.

169. The mechanism of delignification in the sulphate cooking (1). Cooking of alkali lignin with hydrogen sulphide. Nobuhiko MIGITA, Takashi KANDA, Yuichiro SUMI and Tsuneo MATSUMOTO (Journ. Jap. Tappi 8, 263, 1954)

Six kinds of lignin samples, listed below, were cooked with hydrogen sulphide aqueous solution of pH 7 at 100°C, and after cooking the amount of combined sulphur of them was determined.

No. 1: Alkali lignin
No. 2: Methylated alkali lignin (methylating No. 1 with methanol-HCl)
No. 3: Methylated alkali lignin (methylating No. 2 with diazomethane)
No. 4: Methylated alkali lignin (methylating No. 1 with diazomethane)
No. 5: Methylated alkali lignin (methylating No. 2 with dimethylsulphate)
No. 6: Acetylated methylated alkali lignin (acetylating No. 5 with acetic anhydride)

From the results it may be concluded that there are at least two kinds of active group in the lignin molecule which react with sulphur in the sulphate cooking. One of them is probably benzyl alcoholic type OH group (X group), and another is the group (Y group) which can be methylated with methanol-HCl or diazomethane.

The amounts of combined sulphur of both lignin and wood meal samples cooked at 100°C remarkably differ from those at 160°C.

170. Studies on the color of sulphate pulp (I). The causes of color of sulphate pulp. Nobuhiko MIGITA, Takashi KANDA, Shoichiro MOCHIZUKI and Hiroshi NISHIMURA (Journ. Jap. Tappi 8, 277, 1954)

In order to investigate the color of pulp caused by the sulphate cooking, following experiments were carried out. Three kinds of samples varied extremely in the content of cellulose, hemicellulose and lignin, namely groundwood, holocellulose and bleached sulphite pulp were cooked with the liquors of various sulphidities, and the colors developed on these samples were compared by means of I. C. I. system.

(1) Irrespective of the sulphidity of cooking liquor, increase of the cooking time caused increase of the dominant wave length and the purity of pulp, and caused decrease of the brightness of pulp. The rates of increase of the dominant wave length on the three samples were as follows: Sulphate pulp < Holocellulose < Groundwood.

The rates of increase of the purity and of decrease of the brightness were also in the same order. In the case of groundwood, rich in lignin, the purity curve plotted for the cooking time had a maximum point which could not be recognized in the case of the other samples.

(2) From the results it may be concluded that lignin and hemicellulose, especially the former, play an important role in colouring of alkaline pulps.

(3) The soda pulps and the sulphate pulps, prepared by the cookings in which the cooking conditions were controlled as the same as possible except the sulphidity of cooking liquor, contained almost equal amount of pentosan, and less lignin was found in the sulphate pulps. Against the expectation from the comparison of composition of the two kinds of pulps, the sulphate pulps apparently gave longer wave length and lower brightness. Therefore it is considered that the deep color of the sulphate pulp is partly due to the sulphur combined with lignin of pulp.

171. The occurrence of hinokitiol in the wood of *Thuja Standishii* CARR. Tomoichiro NAKATSUKA (Journ. Jap. Forestry Soc. 35, 291-292, 1953)

Hinokitiol (β-thujaplicin) was found in the wood of "Nezuko" (*Thuja Standishii* CARR.). The yield was about 0.006% on the basis of oven-dry wood.

VI. Zootechnical and Veterinary Science

Abstract Nos. 172 — 198

172. Prediction of the dairy performance in goats by the induced lactation with the injection of synthetic estrogen. II. Relation between induced and normal lactation. Motō NAITO, Akira YOKOYAMA, Zenzaburo YOSHIOKA, Takashi YOKOYAMA and Toyokichi YOKOTSUKA (Jap. Journ. Breed. 3, 13, 1953)

The possibility of prediction of dairy performance in virgin goats by means of the induced lactation by the injection with synthetic estrogen was studied by examining the relation between induced lactation and normal lactation.

Sixteen virgin goatlings adopted randomly were injected subcutaneously with 0.25 mg. diethylstilbestrol ("Euvestin") in oil once daily for 20 days in spring, and the induced lactation was examined. The normal lactation following to pregnancy and parturition in the next year was also examined. Further, the relation of dairy characters between these two lactations was investigated. The examined dairy characters were: maximum daily yield (in average 5 of days), maximum period, duration of lactation, total milk yield, average milk yield, coefficient of regression line at rapid increase and average butter fat percentage. To regret, the survived goats at the terminal of the examination fell to six by the disastrous death and accidents, so the obtained figures were examined on the significance in scarce cases. Further, the comparison of mammary gland between these two lactations at the height of milk secretion was carried out histologically by removing the small block of the gland. Results obtained here are briefly summarized as follows.

(1) The differences found between these two lactations were in the first, the daily yield started from 0 in the induced, whereas it started from certain value in the normal, and it took long time to reach the maximum in the former; the second, milk yield and mammary gland were far smaller in the induced than the normal; the third, although the alveoli in the gland were also formed completely, their appearance was more coarse, and larger both in average area of section and in the height of epithelial cells in the induced glands than the normal at the height of milk secretion.

(2) Significant positive correlations of several dairy characters seemed to be present between these two lactations. For instance, the coefficients were, +0.894 in maximum daily yield, +0.774 in total milk yield, +0.874 in duration of lactation, +0.974 in butter fat percentage, and so on. No significant correlation was present in maximum period and in coefficients of regression line at rapid increase. Further, regression equations of characters having significant correlations were settled. Coefficients of correlation between dairy characters in the induced or the normal lactation were also calculated.

(3) Significant positive correlation was also present between alveolar area in section and milk yields in the induced, and similar tendency seemed to be present in the case of the normal lactation. Further, the similarity in the type of udder between two lactations was also present.

(4) The reason of the presence of the significant positive correlation between some characters of these two lactations might be due to the similarity in the basis of mechanism of mammary development and lactation in these two lactations. The reason of the differences between two lactations might be due to the differences in both absolute and relative level of stimulators together with their acting period. Further, the method, dose and duration of administration and examination season were discussed and the conditions mentioned above was seemed to be the most suitable.

In conclusion, although it seems to be hazard to decide as the cases are few, it may be possible to predict the normal dairy performance by the results of the induced lactation with approximate figures, as there are significant and high positive correlations between some of dairy characters of two lactations, for instances, between maximum daily yield, total milk yield and duration of lactation, and so on.

173. Relation between dairy performance and the changes of mammary gland and its stimulators. I. Relation between milk production and mammary structure in goats at the second lactation. Motō NAITO, Yoiti SYODA and Jiro NAGAI (Jap. Journ. Zootech. Sci. **25**, Suppl. 1, 37, 1954)

As the first step of the investigation of the mechanism of exhibition of dairy performance, the structural changes of mammary tissues of three lactating goats with different performance were studied on five stages. Results obtained here are briefly summarized as follows.

(1) As there was no significant difference in the tendency of decrease of daily production after the maximum period between these three goats, the peak production and duration of lactation, especially the former, had a great influence upon the total production.

(2) In the mammary tissue such characters as number of alveolus per lobulus, sectional area of alveolus and number of glandular cells per section of alveolus decrease with the advance of lactation.

Whereas number of alveolus per sight field and height of glandular cells increased, the coefficients of sectional area of lobulus decreased a little.

The tendency of decrease of sectional area of alveolus was particularly similar to that of milk production.

(3) Such characters as the sectional area of alveolus, number of glandular cells per section of alveolus and number of alveolus per lobulus may be important qualities of mammary tissue which related greatly to milk production. And further, it seems to be necessary for exhibiting high production that these characters are as large as possible, and decrease very slowly after the maximum period.

Accordingly, it may be important in the selection of dairy animals to judge precisely on several stages of the lactation the sammary gland quantity and quality mentioned above as the response of the gland to the stimulators.

174. Changes of mammary gland and its stimulators during the gestation and lactation period. I. On the biological assay method of prolactin in the blood serum of lactating goat. Motō NAITO, Yoiti SYODA and Jiro NAGAI (Jap. Journ. Zootech. Sci. **24**, Suppl. 2, 10, 1953)

For the purpose of bioassay of prolactin contents in the blood serum, local

response of pigeon crop sac has been recommended because of high sensitivity. Whereas, it is necessary to use the pigeons of highly purified strain in order to obtain uniform response by means of this bioassay method.

As it is really difficult to obtain such a purified pigeon in the present state of our country, it has been examined on the possibility of such a method as comparing the response of the one side injected intradermally with blood of unknown potency, with the response of the other side injected with standard solution of prolactin.

As the test animal namely the common pigeons weighing from 260 to 340 gr. were employed 2 months after hatch. The response was examined such items as area of positive response, intensity of response, weight per unit area, and epithelial thickness of crop sac.

From results obtained such a comparative method mentioned above may be recommended and it seems to be better to use both area method and weight method than to use only REECE-TURNER's area method.

175. Mechanism of species difference in the mammary development. II. Lobule-alveolar stimulating factor in the hypophysis and adrenal of guinea pig treated with estrogen. Jiro NAGAI, Yoiti SYODA and Motō NAITO (Jap. Journ. Zootech. Sci. **24**, suppl. 2, 10, 1953)

As the second step of the study on the mechanism of the species difference in mammary development, the third mammary gland of 40 ovariectomized mice treated with estrogen and the preparations from hypophyses and adrenals of guinea pig which may contain the mammogenic substance was investigated.

From 2 to 20 guinea pigs per host mouse were sacrificed for the donor. Preparations were the freezing-drying powder of hypophyses and oily ether extracts of adrenals of guinea pigs treated with estrogen for 14 days. Subcutaneous injections of the preparations were given to mice for 10 days simultaneously with estrogen.

Negative results were obtained for lobule-alveolar formation of mammary gland of mice.

On the other hand, the mice treated with DOCA at the level of 2 mg. showed the lobule-alveolar formation. Hence, the strain of mice employed are not insensible to lobule-alveolar stimulators.

From these results it can not be concluded that either these preparations have not any stimulators or, if any, have too small quantity to produce the lobule-alveolar formation.

176. The post-natal histogenesis of the lymph node in the domestic duck (*Anas plathyrhynchos domestica* L.). Shigehiro MORITA and Shiichi NISHIDA (Jap. Journ. Zootech. Sci. **24**, 79-83, 1953)

The post-natal histogenesis of the lymph node of the domestic duck (*Anas plathyrhynchos domestica* L.) was studied. The materials (cervico-thoracal and lumbar lymph nodes from 5 to 180 days old) were fixed in ALLEN-BOUIN's fluid and stained with LILLIE's ('48) Azur-Eosin, BIELSCHOWSKY's silver method and VAN GIESON's collagen staining method.

(1) The lymph node of the duck is composed of such main elements as lymph cords, follicles and peripheral zone. It was found that these elements were enclosed by a thin collagen fiber band, which has not been described definitely in the previous

reports. However, this collagen fiber layer is so thin that we cannot determine whether it can be called capsule or not.

(2) In a five-day-old duck, the lymph node is composed of all kinds of elements mentioned above. With the advancement of age, the components of the node increase the complexity till the age of about 45 days, i. e. the general histological appearance of the lymph node shows adult type by the age of 45 day.

(3) The lymphatic nodules (germ center) are not observed till the age of 30 days but in a forty-five-day-old duck, small spherical lymphatic nodules which contain two sorts of cells, one containing clear nucleus and much cytoplasma, the other dark nucleus and less cytoplasma, are found in a part of follicle. At this age these nodules are not clearly apart from the surrounding lymphatic tissue.

(4) In a sixty-day-old duck, the lymphatic nodules become more clear and the fibrous capsule surrounding the nodule appears clearly at this stage, while such fibrous capsule can not recognized in the mammalian lymph node.

(5) In a ninety-day-old duck, the lymphatic nodule developes more distinctly than that of sixty-day-old duck. The cells of the nodule have much cytoplasma and clear nucleus, and mitotic figures are observed frequently in these nodules. The fibrous capsule surrounding the nodule developes better than at the age of 60 days and contains both lattice and collagen fibers. In the lymphatic nodule the lattice fibers are fewer and finer than those in the other part of the lymph node. No other obvious morphological changes are found, except for an increase in the number of nodules, after this age.

177. Studies on the development of the sexual maturation in the male. II. The growth of sexual organs and metabolic change of testis in the rat. Yoshisuke SUZUKI (Jap. Journ. Veter. Sci. **16**, 1-12, 1954)

Using 300 male rats of Wistar strain, growth of reproductive organs with progress of age was investigated. The author attached great importance to the transition of the comparative weight of organ to body weight and the change in the coefficient of variation in the respective organs for analysing the functional development of the organs.

Two important epochs in the sexual maturation process are pointed out. The first one, Epoch I, found at around 30 days of age is concerned with testicular growth and spermatogenetic function. From the study of metabolic rates of testicular tissue, the most important change in the metabolic pattern of testis is found in this epoch. The second, Epoch II which is concerned with the growth of sexual accessories and the endocrine function of testis, is found at 60～70 days of age.

178. Studies on the development of the sexual maturation in the male. III. Morphological changes in penis and analysis of the sexual maturation process in the rat. Yoshisuke SUZUKI (Jap. Journ. Veter. Sci. **16**, 87-100, 1954)

The present report consists of two parts. The first is on the findings that the shape of the extremity of rat's penis undergoes three successive changes closely related to the development of the sexual organs. (Preliminary report is in Med. and Biol. (J), **18**, 199. 1951.)

In the second part, the developmental pattern of the sexual maturation process in the male rat is discussed and analysed from the results obtained in the series of

the present author's study. (Jap. Journ. Veter. Sci., **14**, 116. 1952, Report of II. International Congress of Physiology and Pathology of Animal Reproduction and of Artificial Insemination **1**, 53. 1952 and Jap. Journ. Veter. Sci., **16**, 1. 1954.)

It is concluded that the sexual maturation process begins at Epoch I. (about 30 days of age) and is completed at Epoch II. (about 60～70 days of age). The former is characterized mainly by the most important changes in spermatogenetic function and growth of testis, and the first appearance of W type penis (hook-like shape penis) and of descent of testis are the external signs of this epoch. The latter marks the accomplishment of endocrine function of testis and of ejaculatory function, and the first appearance of U type penis (adult type) is its external sign.

The reproductive activity, on the other hand, remains at a low level in the early stage of the completion of sexual maturation, gradually increasing to the maximum level towards five months after the birth.

179. Influence of the lactation on the gonadotropic activity of pituitary body. Tomonori IMAMICHI, Teiichi ETO and Tôsirô HOSI (Naibumpi 1, 48-53, 1954)

In the experiment of the intrasplenic ovarian transplantation, the suppressing effect of lactation on the post-castration increase of pituitary gonadotropic activity was found similary to that in the parabiotic experiment, which has been reported in the Records No. 3.

A small piece (2-4 mg.) of infant rat ovary (25 days old) was transplanted into the spleen of the castrated lactating rat whose ovaries were removed at the same time of the transplantation. As the control, mature virgin rats received similar transplantation and castration. Fourteen days after operation, the ovarian graft was weighed and examined histologically.

In the control group (7 cases), the ovarian grafts enlarged and weighed 13-31 mg. Histologically, corpora lutea and large follicles with partial luteinization of the internal theca cell layer were observed in all of them.

In the test group (9 cases), however, the ovarian grafts weighed only 2-9 mg. except one case (28 mg.). Histologically, in 6 out of 9 cases neither large follicle nor corpus luteum was observed, even though a slight luteinization was observed in the internal theca cell layer. And in one case the graft was entirely immature. In one of the remaining 2 cases, the graft contained a small corpus luteum, and in the other one of the graft (28 mg.) had same appearance as that of the control.

180. On the so-called "Federungsphänomen" of elbow joint of horse. Shin-ichi NOMURA (Jap. Journ. Veter. Sci. **15**, 175-182, 1953)

The subject of this experiment is to discuss the PALMGREN's opinion (1929) on the so-called "Federungsphänomen" of the elbow joint of horse and to explain its theoretical foundation.

The mechanical characters of the joint analysed on the band-praeparats are as follows:

(1) The extent of the "Federung" is 33-55% to that of the physiological flexion and stretching. (2) The "Federung" is composed of two kinds of jerking in the direction of flexion and stretching. (3) According to the analyses of their movement, it is supposed that the "Federung" will not result from the peculiar shape of the articulation, but from an inequilibrium of the tensible force of the collateral ligaments, which is brought about through the eccentric adherence of the ligament to the epicondylus of humerus.

Therefore, the kinematical foundation for the "Federung" will be able to conclude that:

(1) The direct cause is the eccentric adherence of the collateral ligaments to the trochlea humeri. (2) and the elasticity of articular cartilage enforces it. (3) It is an acceleration of the velocity of the relative movement between two elements, trochlea humeri and proximal articular surface of antebrachium, and its motive power originates in the stress, derived from a strain of ligament-fibres.

181. **About the mechanical characters of the fetlock joint of horse.** Shin-ichi NOMURA (Journ. Jap. Veter. Med. Asso. **6**, 358-359, 1953)

The mechanical characters of the fetlock joint of horse have been discussed and this joint is determined as a hinge joint, based on the following results: (1) The extent of the movement is 110-150°, including that of the surface against sesamoid bone. The joint of fore limb is about 10° more movable than that of the hind. (2) The locus of the moving bone axis describes a circle which is slightly concave to the medial side. (3) The mechanical axis of rotation, i.e., the instantaneous, O. FISHER's and real axis fluctuate irregularly in a narrow sphere. (4) The pivot angles of the moving bone are insignificant.

Jerking of the mechanical axis, which generally arises in the final position of movement, is scarcely notable. Therefore, it is supposed that the restriction between the opposite elements is so hard that the moving element keeps always the congruent with the articular surface of the fixed bone and its locus goes along a simple, linear course. The shape of the curve of the sagittally sawed articular surface is, of course, a simple circle.

182. **A mechanical study on the tarsal joint of horse.** Shin-ichi NOMURA (Jap. Journ. Veter. Sci. **15**, 281-293, 1953)

According to the author's mechanical studies, the tarsal joint is not a spiral, advocated by A. O. STOSS (1923), but is a typical hinge joint, because of its following features: (1) The born axis, when the joint is bending or stretching, goes along a simple, flatt surface, which inclines to the lateral or medial side only several degree. The extent of its hinge-movement is 95-110°. (2) The mechanical axis fluctuate irregularly within a narrow sphere, excepting the final portion of the movement. (3) The pivot-angle on every unit-movement is insignificant, and the alteration of the direction relates directly to the feature of trochlea tali. (4) The bending or stretching of the bone is conducted mainly by the medial trochlea. Supposing that the direction of the movement is similar to that of the tangent of the trochlea, its margin will be an ellipse, which is found on a cut end of a cylinder. (5) In reality, the curve of the margin of trochlea is an ellipse, which slants to the axis of talus, and its pitch walks with definite measure. (6) These features of the tarsal joint are derived from the direction of insertion of M. gastrocnemius, which keeps on the course from the upper-inside to the lower-outside. (7) Besides, the "Federung" of the tarsal joint is brought about by the eccentric insertion of the longer branch of the collateral ligament to the margin of the trochlea tali. The mechanism is the same as with the elbow joint.

183. Comparison of labouring power between horse and cattle. Analysis of the motion in unstrained walk. (I) On the vertical movement. Toshio OKABE, Yoshio SETO, Takayoshi MIURA, Shin-ichi NOMURA and Hiroshi SAWAZAKI (Jap. Journ. Zootech. Sci. **24**, 60-64, 1953)

The authors observed vertical movements of several parts of the body in five horses and three cattles, during their unstrained walks, through a serial photography (25n/sec.) and a cyclegram.

The body-axis moves, like a both-end-supported-beam, putting the periodic pressure on its middle part. Then, the head and the tail take opposite phases and there are two stable parts, at the forward and backward of the thorax. The elbow and knee joints are rather stable than the other parts; i.e., the locus of these parts are in parallel with the ground. Upper parts of the body locomote with a uniform velocity, and lower parts vary in velocity corresponding with the actions of limb.

The locus of the trunk has two waves for one stride, and the amplitude becomes higher in proportion to the distance from the middle part. On the other hand, the locus of the limb has one wave, and that of the free parts indicates the characteristics respectively.

It is noteworthy that the walking manner of the horse is rather elastic while that of the cattle is short-stepped.

184. Comparison of labouring power between horse and cattle. Analysis of the motion in unstrained walk. (II) On the alteration of joint-angles. Toshio OKABE, Yoshio SETO, Takayoshi MIURA, Shin-ichi NOMURA and Hiroshi SAWAZAKI (Jap. Journ. Zootech. Sci. **24**, 86-90, 1953)

Through a serial photography (25n/sec.), we analysed the alteration of 14 joint- and inclination-angles during the unstrained walk. The subjects were five horses and three cattles.

The inclination-angle of the head alters oppositely to that of the neck. The head and neck perform a lever without change of their relative positions. The upper parts of the limb show one wave in one stride and a remarkable variation caused by the burden of the body-weight. Contrarily, the free parts of the limb pass through with variable rates and their characteristic processes. Besides, the angles sway remarkably, when the limb leaves the ground with a strong snapp.

We can find a obvious difference in the phases, when cattle and horses have the largest or smallest value of their joint-angles.

185. On the undulation of the so-called resting respiration. Toshio OKABE and Hiroshi SAWAZAKI (Jap. Journ. Veter. Sci. **15**, Nos. 5 and 6, 1953)

In an attempt to study, objectively, the continuous and particular observation of the respiration, the authors measured the pneumotachogram of the rabbit. The authors also discussed the undulation of the so-called resting respiration by the auto-correlation coefficient. Two or three repetitional experiments were carried out on the same individual, and obtained almost the same results. The results of the observation of the five individuals are as follows. (See the following table)

(1) There is undulation of time interval in each case.

(2) At least, the amplitude fluctuates under influence of the previous respiration, and some of them prove the undulation undoubtedly.

Rabbit Number	Undulation			Coefficient of Variance			T-A Correlation	
	T	A	V	Great	Middle	Small	Regression term	Judging
No. 2	+	+	+	T	V	A	−0.62	+
No. 3	+	±	±	T	V	A	−0.62	+
No. 5	+	+	−	T	V	A	−0.65	+
No. 8	+	+	−	T	A	V	−0.71	+
No. 9	+	±	±	T	A	V	−0.81	+
Note	+: undulation ±: indefinite		−: no undulation				+: significant (α=0.01)	
	T: Time interval			A: Amplitude			V: Volume	

(3) The analysis of correlation between the time interval and amplitude brings us the result that all regression terms are negatively efficient ($\alpha = 0.01$).

(4) The coefficient of variance of the time interval is greater than that of others.

(5) In two cases, the relative value of volume fluctuates with no influence.

So we think that the time interval and the amplitude compensate each other to regulate the stability of the volume.

186. Studies on the serum-cholinesterase of horses. III. The supplements. Takayoshi Miura (Jap. Journ. Veter. Sci. **15**, Nos. 5 and 6, 1953)

(1) In the last report, T. Okabe and the present author recognized that there were certain relations between the activities of serum-cholinesterase and the exercises about the horses. The author has endeavored to make clear the reason.

By venous injections of acetylcholine the activities of the esterase decrease obviously after 5 min., and do not recover their normal values even after 60 min. And by adrenaline, the activities in 5 min. after the injections are rather high and after 60 min. become rather lower than each normal value. The author thinks that the decrease of the activity, caused by severe exercise, corresponds to the acetylcholine injections and the small increasing of activities, by repeated light exercises, are similar to the adrenaline injections. In the former case, the excitement of the parasympathetic nervous system in recovering stage occurs without the adaptation of the organism, so the activity of the esterase decreases from normal value to hydrolyse the acetylcholine which has been introduced in the blood by the parasympathetic excitement. In the latter case the adrenaline is delivered into the blood by the excitement of the sympathetic nervous system, and then the cholinesterase activity increases, as a result of adaptation of the organism to this condition. Thus the activity immediately after the injection or the exercise is higher than the normal value, but in 60 min. after, it is rather lower than usual for the same reason as in the former case.

(2) The author tried to observe the connection between the fluctuation by the seasons (first report) and the alteration by the exercise or labor, in the serum-cholinesterase activities.

Measuring the alterations of activities through a year in 5 farm horses, in comparison with each one labor-quantity, it was found that the activities of the farm horses are influenced by their labor-quantities. Especially in early spring, when the

labor-quantities increase suddenly from the resting winter season, the decrease of the activity is so large that the fluctuations by the seasons disappear. But, in summer and in autumn, the influences of the labor-quantities are not so large to cover the fluctuations by the seasons. It is considered to be the temporary formation of the so-called sportsman's diathesis, as can be seen in the last stage of the race horse training (last report).

As the conclusion of this study, it is assumed that the activities of serum-cholinesterase have some relations to the exercises or labors of animals, at least of horses, and some of the grounds for these relations have been evidenced.

187. Studies on the autonomic balance in livestock. I. On pharmacological method of testing in horses. Toshio OKABE and Tadayoshi MIURA (Jap. Journ. Veter. Sci. **16**, 1, 1954)

Since EPPINGER and HESS, there have been many studies on the autonomic balance in human beings, but none dealing with livestock. Nevertheless, we have known in horses the individual differences in autonomic tensions from their various temperaments or capacities for exercises and from the recent reports by the authors on their serum-cholinesterase. So the authors intended to measure their autonomic balance. In this report the authors describe their investigations as to the pharmacological method for horses.

The authors tried to find the autonomic balance by observing the sensibility of the sympathetic and parasympathetic nerves to adrenalin and acetylcholine dosing in vena. The blood pressure, the pulse and respiration frequency, and the body temperature were counted or measured, before the injection, each minute after injection up to 5 min., then in 10 min., 15 min., 30 min., and 60 min. intervals after the injection. Sweating, pupil's square and the other clinical conditions were observed during the whole course. The doses that were injected, to ten horses at intervals of a week or more were gradually increased, from 0.02 cc of 1/10000 adrenalin or 1/100000 acetylcholine solution per 100 Kg body weight.

Before the investigation, we found the distributions of the normal values and the ranges of the physiological fluctuations of the pressure, the pulse, the respiration and the temperature to compare with the influence of the injections. The pressure had individual differences, but was maintained constantly in each; the pulse and the respiration, especially the latter, were unstable, nevertheless the temperature was rather stable in physiological condition.

According to the results of the experiments on 30 samples, 0.4 cc-0.5 cc per 100 Kg body weight are recognized as the proper doses in both injections. Between these doses, the definite increase of the blood pressure and sweating in every case and the clear increase of the pulse frequency in some cases were induced by adrenalin; by acetylcholine, only the decrease of the blood pressure was definite. And all the above mentioned reactions did not continue for 30 min. or more.

In the doses of less than 0.35 cc the reactions were small and not definite in every case, in the cases of more than 0.6 cc the reactions were more definite, but continue to have bad effects for horses.

About the respiration frequency and the other items we could not see any definite reactions in regard to doses and cases.

188. Studies on the autonomic balance in livestock. II. The classification of individual differences in horses. Toshio OKABE and Tadayoshi MIURA (Jap. Journ. Veter. Sci. 16, 2, 1954)

By the pharmacological method, as cited in the previous report, the authors investigated the excitabilities of the sympathetic and parasympathetic nerves in about 40 horses.

From the results of the above examinations the authors decided the standards for judging the excitability of sympathetic or parasympathetic nerves are as follows.

The excitability of sympathetic nerve (+) or Adrenalin test positive.

i. Blood pressure increases more than 109.3% within 5 min.

ii. Pulse increases more than 128.9% and sweating is profuse within 5 min.

The excitability of parasympathetic nerve (+) or Acetylcholine test positive.

Blood pressure decreases less than 93.3% within 5 min.

Those other than the above mentioned are (—) or negative in each case.

The changes in blood pressure was induced in almost every horse by both gifts. So 109.3% or 93.3% is the mode of these changes, and (+) or positive and (—) or negative show the degrees of the changes. As to the pulse, the changes were only induced in several cases by adrenalin. 128.9% is the upper range of the physiological fluctuation, so in this time (+) or positive and (—) or negative mean as each word means.

Thus, judging the excitabilities of the sympathetic and parasympathetic nerves by pharmacological method, the autonomic balances in horses were classified into 4 types as shown in the Table 1.

Table 1. Classification of Autonomic Balances in Horses.

Type		Sympathicotonic S	Parasympathicotonic P	Autonomic Unstable U	Autonomic Stable St	Total
Adrenalin Test		+	−	+	−	
Acetylcholin Test		−	+	+	−	
Samples		9	11	9	8	37
Race	Thoroughbred	1	0	3	0	4
	Arab & Angroarab	3	8	4	2	17
	Halfbred	5	3	2	6	16
Sex	Stallion	2	0	1	0	3
	Gelding	4	6	5	7	22
	Mare	3	5	3	1	12
Age	3	1	0	1	0	2
	4–8	2	3	2	0	7
	9–14	6	7	6	5	24
	15–19	0	1	0	3	4

The results show that the autonomic balances in horses are distributed almost equally in between 4 types; but, when the results by breds, ages or sex, are observed there are interesting distributions as we consider the specialities in relation to their temperaments, constitutions and abilities in exercises, although we can not reach a decision at present because of the small number of samples in each case and the necessity of further investigations.

189. Effect of morphine on dehydrogenation in the cat's brain. Norimoto URAKAWA (Folio Pharmacol. Japon **49**, 193 [Proc.])

Dehydrogenation of the cat's and guinea pig's brain (homogenate) to morphine was investigated.

Morphine was incubated previously with the homogenate according to either of the two following methods: (1) for 30 min. at 4-5°C and subsequently 10 min. at 37°C (preincubation A), (2) for 30 min. at 4-5°C and 30 min. at 37°C (preincubation B).

The terminal concentration of morphine was 3.3:2.6:6.6:13.3 mM. Both cases of the preincubation A and B increased markedly inhibition produced by the high concentration of morphine, whereas preincubation B showed negative inhibition slightly by the law concentration in the guinea pig's brain.

On other hand the preincubation A and B did not increase inhibition of the high concentration of morphine, and preincubation B showed clearly negative inhibition of the low concentration in the cat's brain.

190. Factors necessary for *E. tenella* infection of the chicken. I. The influence of the digestive juice on infection. Miyoshi IKEDA (Jap. Journ. Veter. Sci. Suppl. **15**, 42-43, 1954)

The freeing of sporozoites from coccidial oocysts of the chickens has been studies by a few workers. Very little, however, is yet known about the mechanism of the liberation of sporozoites, though it is now generally believed that the liberation of sporozoites is brought about by the action of the digestive juices, especially the pancreatic juice or enzymes present in the duodenum, in addition to the effects of body temperature and intestinal humidity. On the contrary to such views commonly held on the problem, recent studies of ITAGAKI (1953) on the infectious process of coccidia in the chicken, emphasize that the libeartion of sporozoites may not be influenced by the biochemical action of the digestive juices, but chiefly by the mechanical action in the crop and the gizzard.

Certain discrepancies in the results reported in the field, made it desirable to take up this problem again and to determine the conditions and factors necessary for bringing about the liberation of sporozoites from oocytes of E. tenella in vivo.

(1) The pancreatic and bile ducts were respectively ligated in some chickens of coccidia free White Leghorn from two to four weeks of age. Two days after surgical operations the treated chickens were inoculated into the crop with certain amounts of sporulated oocysts (*E. tenella*).

None of the chickens with ligated pancreatic ducts became infected, but others were infected.

(2) From the above observations, negative results might be obtained from the cause that the cecal epithelium of the ligated (pancreatic ducts) chickens was unsuitable conditions for the coccidial growth. To clarify the problem, infection of the ligated chickens was attempted with merozoites which were collected from cecal contents of a chicken destroyed on the 5th day after infection and inoculated into the portion of the ceca entrance through the cloaca.

The results indicated that the cecal epithelium of the ligated chickens was suitable for the growing of coccidia without being altered physiologically because, even in this case, infection resulted and oocysts were discharged 2-3 days after inoculation.

(3) All the feces passed by the ligated (pancreatic ducts) and control chickens were collected during 24 hours following the inoculation with the sporulated oocysts. The relative number of sporulated oocysts in each lot of feces was estimated by comparing the number of discharged oocysts per gram of the feces. It was estimated that the feces of the ligated chickens contained 19 times as many oocysts as those of control.

The results obtained are summarized as follows:

(a) Infection of the chicken with *E. tenella* is not brought about by the action of the bile juice, but the pancreatic juice.

(b) The pancreatic juice may be necessary for the excystation of oocysts in vivo for the reason of experimental results (2) (3) mentioned above.

191. Site of acetylcholine production in the wall of intestine. Nobuyuki CHUJYO (Amer. Journ. Physiol. **174** (2), 196-198, 1953)

As found previously by the author that the extended wall of the intestine produces larger amounts of a substance which is apparently acetylcholine (ACh) than the non-extended, a search for the site of ACh production has been attempted in the present study.

ACh amounts were determined in the following preparations of the guinea pig intestins: a) segments stretched in both direction (LC), b) segments stretched in circumference (C), c) segments stretched longitudinally (L), d) nonstretched seggents (N) ACh assays were made on the eserinized frog rectus muscle.

Effect of direction of stretching on ACh production: The results can be represented in general by the following expressions: ACh amount in $N \rightleftharpoons L < C \rightleftharpoons LC$. It is suggested that circumferential stretching may cause an increase of the ACh amount in the wall of the intestine and longitudinal stretching may not.

Effect of cocains on ACh production. The effect of cocains on ACh production in the extended intestine was studied to ascertain whether the intrinsic nerves are concerned with increase of the ACh amount. Preparation C (stretched circumferentially) were kept in Tyrode solutions containing cocaine and the ACh amounts in these preparations were compared with those in preparations N and C kept in Tyrode solutions without cocaine. The effect of this stretching on ACh production appears not to be affected by cocaine which is expected to paralyze the instrinsic nerves. The paralyzing effect of cocaine on the intrinsic nerves was confirmed by the lack of the stimulating effect of small doses of nicotine. The results mentioned above suggest that the most probable site of ACh increase, when the wall is extended, is the circular muscle layer, if the proposed independence of the ACh increase on the intrinsic nerves is true.

192. Effects of Al and Mn on the bone growth. Iwao YANAGIYA, Shoichi SHIMADA and Yoshio OKUBO (Folia Pharmacol. Japon **50** (1), 45, 1953)

Nutritional disturbances of animals which are characterized by a failure of bone development are mostly caused by excessive supply of the phosphorus. The present study deals with the effects of Al and Mn on such a disturbance of the bone growth.

Exp. 1. Effects of Al and Mn on excretion of P and Ca in the rabbit. Amounts of P and Ca in the excretion of rabbits fed on the rations containing P beyond the normal requirement were determined with the stool and urine collected in the dura-

tion of 20-44 hrs. and 44-68 hrs. after the ingestion. When different aluminium compounds and succinic acid were administered, amounts of calcium excreted were as follows in their order: succinic acid 1.0 g. > control > aluminium succinate 0.5 g. > aluminium succinate 1.0 g. > aluminium hydroxide 1.0 g. Aluminium hydroxide minimarizes the Ca excretion, reducing the amount below that of the ingestion. P excretion in the stool increases markedly in the case of the aluminium administration. Instead of Al similar experiments on Mn were carried out, but no effect demonstrated.

Exp. 2. Effects of Al and Mn on the bone growth. Rats (Av. 100 g.) were fed on diets which contained Ca and P in the ratio of 0.5, 1.0, 2.2, and 4.0 P/Ca. The growth of the bones were observed with the Pb-lines which appeared by depositing the Pb from the Pb salt solutions injected repeatedly at certain time intervals (OKADA's method).

If P/Ca ratio is large (cases of 2.2 and 4.0), the Pb line may appear not constantly, being found at 45% of cases of P/Ca 2.2 and 25% of cases of P/Ca 4.0. When the alkaline salts, such as sodium bicarbonates or tertiary sodium phosphates, are injected simultaneouslywith the Pb salt, the Pb deposition appears more frequently than that of the sinyle ingestion of the Pb salt.

193. Studies on the anthelmintic efficiency of 9.5% Ascaridole emulsified (Askis for veterinary) for dog ascarids, *Toxocara canis*. Shin OKOSHI and Atsushi WATANABE (The new veterinary clinics 1, 38, 1953)

Recently, we have applied ascaridole compounds as anthelmintics for ascarids and hookworm (*Ascaris lumbricoides, Ancylostoma duodenale, Necator americanus*). However, dogs and cats die with ill effects, when ascaridole compounds (Askis for medicine) was used in attempting to remove parasites from the dog and cat. Therefore, the anthelmintic efficiency for dog ascarids (*Toxocara canis*) was tried by administrations of 9.5% ascaridole emulsified and 70% ascaridole (Askis for medicine). Accordingly, it was observed that 9.5% ascaridole emulsified has given the most satisfactory efficiency for dog ascarids and no ill effect to dogs.

As for studies on the toxicity, the authors applied capsules of 9.5% ascaridole emulsified (each capsule containing 0.2 g) and 70% ascaridole (each capsule containing 0.2 g) to 17 dogs and 3 cats, and examined the ill effects on dosage of these drugs. As studies on the vermicidal examination, the authors administered internally capsules of 9.5% ascaridole emulsified to 21 dogs infected by *Toxocara canis*, and studied the worms which were destroyed in feces after the treatment, and more tried the fecal examination.

Results were as follows:

(1) It is dangerous to administer internally 70% ascaridole (Askis for medicine) to dogs.

(2) Non-toxic to every dog was observed when administered internally capsules of 9.5% ascaridole emulsified (each capsule containing 0.2 g of 9.5% ascaridole) as follows:

in pupies, 40 to 50 days old, 1 capsule; in young dogs, 2 to 3 months old, 2 capsules; in adult dogs, 5 capsules.

But it is dangerous to administer internally these doses in cats.

(3) The purpose on the anthelmintic treatment for dog ascarids without ill

effects was accomplished by the administration of 9.5% ascaridole emulsified (Askis for veterinary) 0.1 to 0.2 g/kg body weight.

194, Studies on the treatment of *Schistosomiasis japonica* in cattle. Shin OKOSHI, Takeo TAKAHASHI and Toshio ISHII (Jap. Journ. Parasit. **2**, 33, 1953)

The authors tried an experiment on the treatment of *Schistosomiasis japonica* in cattle by antimony therapy in Yamanashi prefecture. In this experiment, they reduced the time of antimony injection to less than five, and tried the impact therapy by antimony. Thereafter, they made thorough examination on the reapparance of ova through 7 to 10 months.

Results were as follows:

(1) The authors accomplished their purpose of mass treatment of infected cattles by the injection that it's time was less than 5 times and total doses were 24.8 to 26.1 mg/kg of sodium-tartar-emetic.

(2) As it was observed that the results of the examination for ova, which was tried at 2 to 3 months after antimony therapy, became to discrepeant with results at 7 to 10 months later, the observation must be continued to confirm the perfect cure of *Schistosomiasis japonica.*

(3) A few perfect curative samples were observed even when injected a little dose of sodium-tartar-emetic less than the perfect lethal doses.

195. Studies on the treatment of *Schistosomiasis japonica* in experimentally infected rabbit. Shin OKOSHI, Toshio ISHII and Takeo TAKAHASHI (Jap. Journ. Parasit. **2**, 91, 1953)

The authors studied the relation between the dose and frequency of the injection of sodium-tartar-emetic, and on the reappearance of ova after injections. Every rabbit used to examination was infected with cercariae collected from 4 or more snails (*Oncomelania nosophora*).

The fecal examination was continued over three months by the direct smear method and A.M.S. III method. And the existence of worms and ova were confirmed by autopsy of the rabbits.

Results were as follows:

(1) We were able to recover from *Schistosomiasis japonica,* when we have injected 3.4 mg/kg of sodium-tartar-emetic with the frequency of 20 times or more, and 10.4 mg/kg with the frequency of 5 or more. Accordingly, we know that it is able to shorten the number of times of injection by the impact therapy of antimony compound.

(2) In the perfectly recovered rabbit, we observed that the black degenerate ova have remained in the tissue of the small intestine through 4 months or more.

(3) By the insufficient dose of antimony compound, we observed the reappearance of ova 41 to 71 days later, though the fecal examination showed once negative (17 to 25 days after the injection). That is to say that the confirmation of this disease by the fecal examination have need of the reobservation which is performed after 70 days or more.

196. Studies on the consequences of ova of *Schistosoma japonicum* and *Eurytrema pancreaticum,* inoculated into the portal vein and the tissue of the intestine. Shin OKOSHI, Toshio ISHII, Takeo TAKAHASHI, Mampei USUI, Masanobu FUKUI and Isamu TOMODA (Jap. Journ. Parasit. 3, 51, 1954)

We have usually diagnosed the schistosomiasis by the fecal examination or the membrane scratching method. But on the course of the treatment it was so difficult to confirm the fate of the adult, that the authors often found the reapearance of ova, occasionally even after two months. So an experiment was tried to know how long ova can remain in the tissue of the intestine or in the portal vein.

Methods and results were as follows:

(1) The consequences of ova of *Schistosoma japonicum*:—

About 1.000 ova were inoculated which were collected from the uterus of the worm, into the tissue of caecum of dogs. 32 days after the inoculation, a mass of half-collapsed ova in the tissue of caecum could be found but 61 days after the inoculation no ovum at all to be found.

Thereupon about 1.000 ova were inoculated into the ligated portal vein (the region of jejunum), and after one and also two months none of them could be found.

In each case, the authors could not find ovum by the fecal examination.

(2) The consequences of ova of *Eurytrema pancreaticum*:—

The ovum of Eurytrema is similar but smaller than the ovum of *Schistosoma japonicum,* and does not hatch out of the shell in the water (its hatching is performed in the intermediate host). So it can be considered as some kind of heterogenous substance.

About 3.000 ova, which were collected from the uterus of the worms were inoculated into the tissue of caecum of dogs. The results, which were obtained 181 days after inoculation, showed distinct existence of a mass of perfect ova.

Then the inoculation of 3.000 ova of *Eurytrema pancreaticum* was performed into the ligated portal vein. Scattered ova in the liver of every dog could be seen which was examined 27 days or more after the inoculation, though no ovum in the tissue of the portal vein and intestine could be found.

The fecal examinations have always shown negative.

197. Studies on haemolytic streptococci. IV. On non-haemolytic streptococcus isolated from guinea pigs. Yuichi OCHI, Manabu OGATA, Heiji SATO, Shinichiro KONISHI and Eiichi YOSHIDA (Jap. Journ. Veter. Sci. 15, 259-272, 1953)

Dr. OCHI, one of the collaborators in this study previously made studies on haemolytic streptococcus isolated from many kinds of animals, classified them clearly into five types, and stated that the one having pathogenicity for guinea pigs belonged to type II as enumerated in his report.

Heretofore, it had been reported by many authors that the streptococcus which caused guinea pigs to suffer from the infectious disease, belonged to C group of LANCEFIELD and assumes to beta type of haemolysis.

Some of the guinea pigs used in the laboratory, last April and September, died one after the other, several days after the inoculation or before the inoculation of materials for the isolation of bovine tubercle bacilli.

In the former epizootic, haemolytic streptococcus was isolated from the heart blood, organs, and lymph nodes of four of those animals that had died of strepto-

coccosis, while non-haemolytic streptococcus was isolated from the heart blood, organs and lymph nodes of six others. In the latter, haemolytic streptococcus was isolated from 13 of 15, while non-haemolytic streptococcus was isolated from 2. Most of the streptococci were purely isolated from each organ and the mixture of the two types was never seen in an individual.

The haemolytic streptococcus which was isolated during these two epizootic periods was clearly identified with Dr. OCHI's so-called II type in its morphological, cultural and biological properties, and its virulence upon the small laboratory animals.

And the non-haemoytic streptococcus that was isolated from the same group during the same period was well identified and found to possess the same properties except for the lack of the haemolytic nature.

The studies on the streptococcus have been, so far, mostly dealt with the haemolytic streptococcus, while the non-haemolytic streptococcus was ignored as it seemed to have little virulence except in some special diseases.

Therefore, the authors believe this fact is very important and should never be overlooked in regard to the pathogenicity and the classification of haemolytic streptococcus.

We studied as well, the mutual variability of these two types, streptolysin, prosperity and decay in tubes and in the bodies of animals, as the mutual influence by mix culture of both types, and obtained the results described below:

(1) It is known the non-haemolytic streptococcus, which is pathogenic to guinea pigs exists, and also that the properties can be identified with those of Dr. OCHI's II type except for the lack of the haemolytic nature.

(2) The M type of haemolytic streptococcus was passed through a series of mice, and it variated into M or S type of the non-haemolytic streptococcus at an inconstant period.

(3) Among the non-haemolytic streptococcus variated by the mouse passage, M type has the same properties as the non-haemolytic streptococcus from guinea pigs, and S type, the properties of which may be identified with the variant strain on the medium from M type of nonhaemolytic streptococcus, isolated from guinea pigs. These, of the S type, are closely related to Enterococcus by their morphological, cultural, biological and pathological characteristics.

(4) These non-haemolytic streptococci seem to be the variant strains which have lost the ability of haemolysin production of the typical II type.

(5) In the mix-inoculation for mouse passage, or the mixculture of haemolytic streptococcus and non-haemolytic streptococcus in tubes or in the bodies of animals, a constant phenomenon in which the mutual change of the haemolytic nature is promoted in one side or the other by the simultaneous existence of each type had never been recognized.

198. Studies on AVIAN type tuberculosis. VI. Effect of sensitization on YERSIN type tuberculosis in rabbits. Shutaro YAMAMOTO, Kiichi ISHIDA, Kosaku FUJIWARA and Akio SATO (Transac. Soc. Path. Jap. 42, Edit. Gen. 545-546, 1953)

The effect of sensitization with avian tubercle bacilli on the acute form of experimental avian tuberculosis in rabbits has already been reported by authors in previous paper; the distribution of lesions and bacilli in YERSIN type tuberculosis had been modified by sensitization and they showed features resembled VILLEMIN

type tuberculosis.

This time the authors performed a serial observation of 13 reinoculated rabbits, which received subcutaneous injection of avian tubercle bacilli 3 weeks previously. The reinoculation was done intravenously with the dosis of 0.1 mg. per kilo. of high virulent avian tubercle bacilli, and at the same time 6 normal rabbits were inoculated intravenously with the same dosage as the control animas. Besides, another 3 sensitized rabbits, which received 3 dosis of intravenous injection of India ink before reinoculation, were also examined. All sensitized animals gave distinct positive reaction following intradermal injection of avian tuberculin (1:10) at the time of reinoculation. The first two groups were sacrificed in turn 30 minutes, 3, 6, 12, 18 and 24 days after reinoculation and the India ink animals were examined after 6, 12 and 24 days respectively. The fate of the bacilli in the organs was examined by quantitative culture method and, supravital preparation of liver, spleen and lung were made immediately after death. All animals were also examined histopathologically, and the extent of the lesions in the liver, spleen, bone marrow and lung were recorded as the percentages of the areas of the lesions in the microscopic fields of sections. The results obtained are summarized as follows:

(1) The growth of bacilli in the liver and spleen was strongly inhibited in the reinoculated groups. The bacilli in the bone marrow, lymph node and adrenal also show similar tendency, though not so marked as liver and spleen. On the contrary, the amount of bacilli in the lung and kidney reffers very little from that of YERSIN type and does not decrease to the end of the observation. In the liver and spleen of India ink animals the bacillary growth is not so much inhibited as simply sensitized animals, and in the organs in which the effect of sensitization appear rather weakly, the bacilli continue to increase, especially in the kidney of the India ink animals the amount of bacilli exceed that of YERSIN type at the later stages.

(2) The extent of the lesions goes almost parallel with the grofth of bacilli in the YERSIN type. However, in sensitized animals the lesions appear in very early stage. Diffuse proliferation of large mononuclear cells appears already after 3 days in the liver of sensitized animals. Also in the lung, other than diffuse thickening of alveolar walls, well defined tubercle formation is seen already after 3 days. It is peculiar that no bacilli can be found or they are quite a few in number in the lesions of sensitized animals, in spite of their early development. The lesions of the sensitized animal reduced suddenly 24 days after reinoculation and there are some scattered giant cells among the liver cells. The effect of India ink upon the histopathological changes seems to be parallel with the effect on the growth of bacilli in the organs; for instance, the liver showed somewhat circumscribed accumulation of large mononuclear cells with India ink particles and they still remained in considerable amount even after 24 days.

Thus in reinoculated animals with the same dosage of the bacilli, by which the YERSIN type tuberculosis should be produced, the lesions similar to those of VILLEMIN type appear in relatively early stage by reduction of liver lesions and gradual development of the lung lesions.

As conclusion, the authors gave attention to the liver lesions of reinoculated animals and after comparison with other organs emphasize the fact that the effects of sensitization differ greatly according to the organs and found that such a disease as experimental bovine tuberculosis in rabbits, which is characterized by lung lesions is far more complicated one compared with the YERSIN type tuberculosis.